AN INTERVENTIONAL STUDY OF PARS TENSA RETRACTION POCKETS - A COMPARISON BETWEEN GROMMET INSERTION AND MEDICAL MANAGEMENT

Dissertation submitted to

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

in partial fulfilment of the regulations for the award of the degree of

M.S.DEGREE BRANCH -IV OTORHINOLARYNGOLOGY

APRIL 2013

COIMBATORE MEDICAL COLLEGE, COIMBATORE

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI

DECLARATION

I solemnly declare that the Dissertation entitled **" An interventional study f Pars tensa retraction pockets - A comparison between grommet nsertion and medical management "** was done by me at Coimbatore Medical College & Hospital during the period from September 2011 to November 2012 nder the guidance and supervision of **Prof.Dr. V.Aravinthan, M.S. ENT , DNB.**

This dissertation is submitted to The Tamilnadu Dr. M.G.R Medical University towards the partial fulfillment of the requirement for the award of M.S. Degree(Branch IV) in Otorhinolaryngology.

Place : Coimbatore
Date:

Dr. Chithra Revi
M.S. (E.N.T) Post Graduate
Coimbatore Medical College
Coimbatore

CERTIFICATE

This is to certify that this dissertation entitled "**AN INTERVENTIONAL STUDY OF PARS TENSA RETRACTION POCKETS - A COMPARISON BETWEEN GROMMET INSERTION AND MEDICAL MANAGEMENT**" submitted by Dr. Chithra Revi appearing for M.S.ENT (Branch IV) Degree Examination in April 2013 is a bonafide record of work done by her under my direct guidance and supervision in partial fulfillment of regulations of The Tamil Nadu Dr. M.G.R. Medical University, Chennai. I forward this to The Tamil Nadu Dr. M.G.R. Medical University, Chennai, Tamil Nadu, India.

PROF. DR.V. ARAVINTHAN,
PROFESSOR AND HEAD OF THE DEPARTMENT,
COIMBATORE MEDICAL COLLEGE,
COIMBATORE.

THE DEAN,
COIMBATORE MEDICAL COLLEGE,
COIMBATORE.

Coimbatore Medical College

COIMBATORE, TAMILNADU, INDIA - 641 014

(Affiliated to The Tamilnadu Dr. MGR Medical University, Chennai)

ETHICS COMMITTEE

CERTIFICATE

Name of the Candidate : DR. CHITHRA REVI

Course : M.S. ENT

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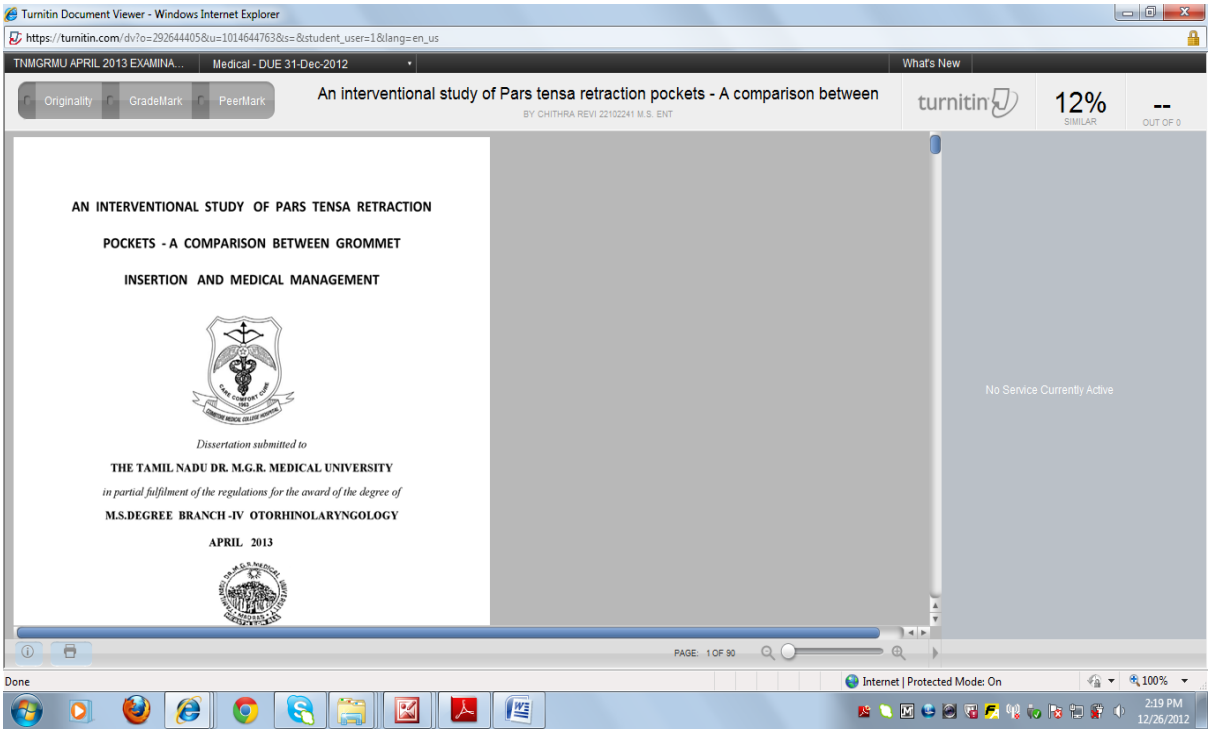
Dr.Chithra Revi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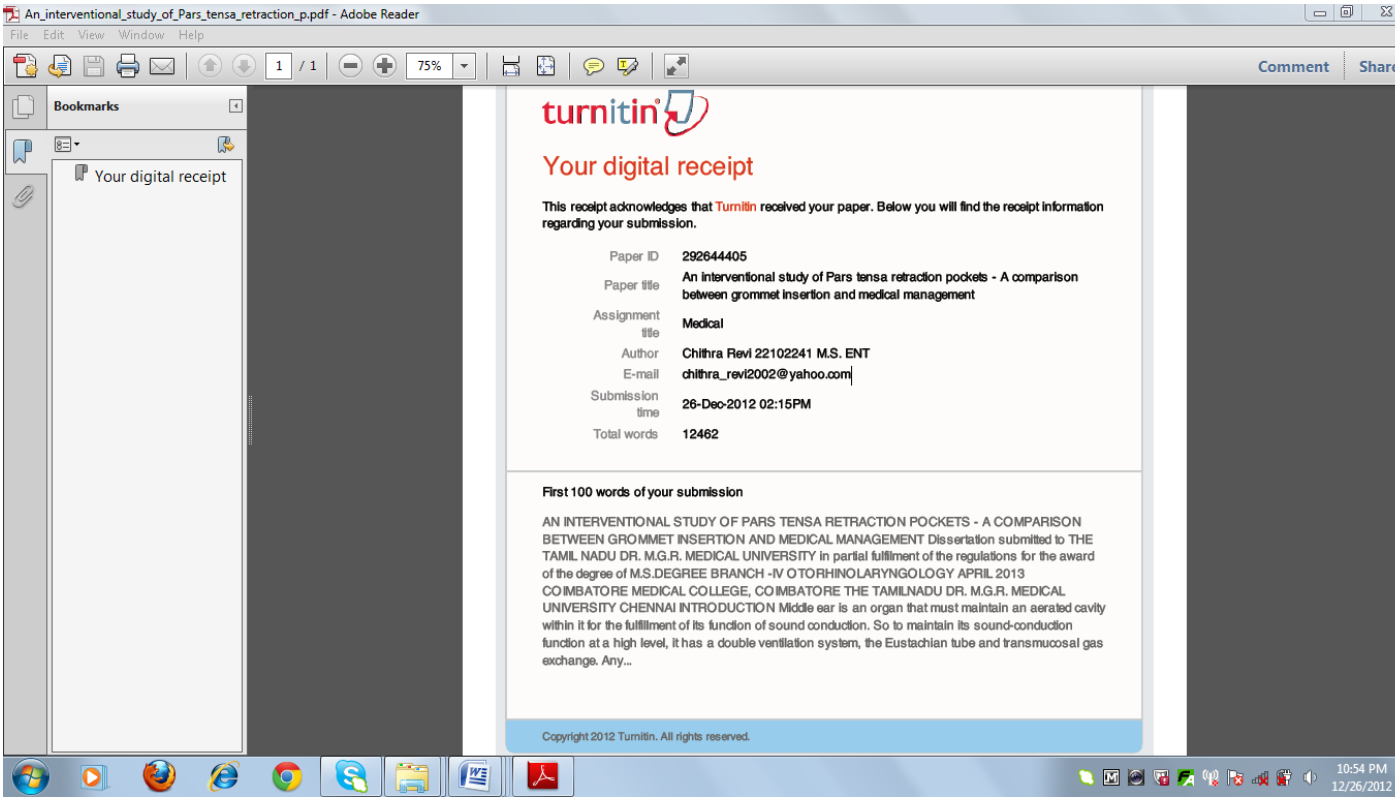
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AN INTERVENTIONAL STUDY OF PARS TENSA RETRACTION POCKETS - A COMPARISON BETWEEN GROMMET INSERTION AND MEDICAL MANAGEMENT Dissertation submitted to THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY in partial fulfilment of the regulations for the award of the degree of M.S.DEGREE BRANCH -IV OTORHINOLARYNGOLOGY APRIL 2013 COIMBATORE MEDICAL COLLEGE, COIMBATORE THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY CHENNAI INTRODUCTION Middle ear is an organ that must maintain an aerated cavity within it for the fulfillment of its function of sound conduction. So to maintain its sound-conduction function at a high level, it has a double ventilation system, the Eustachian tube and transmucosal gas exchange. Any...
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ABSTRACT

BACKGROUND OF THE STUDY

Surgical management of retraction pockets of tympanic membrane is still controversial. In patients with no predisposing cause , the course cannot be predicted. In some patients it progresses towards cholesteatoma & in some it remains asymptomatic. Hence dilemma arises in surgically managing the retraction pockets as the hearing acuity remains normal until later in the disease course & we are not able to predict the course towards cholesteatoma.

AIMS AND OBJECTIVES

1. To find out whether early intervention of retraction pockets can prevent progression to cholesteatoma.

2. To compare the efficacy of myringotomy and grommet insertion and medical measures in the management of pars tensa retraction pockets.

MATERIALS AND METHODS

This study titled "An interventional study of Pars tensa retraction pockets - A comparison between grommet insertion and medical management" was done in the Department of Otorhinolaryngology, Coimbatore Medical College Hospital from September 2011 to Novenber 2012. Patients attending the outpatient department who had Pars tensa retraction pockets of grades II and III according to Sade's classification and having no predisposing nasopharyngeal and paranasal sinus pathologies were selected and divided

randomly into two groups. Each group comprised 25 patients each. Pre operative evaluation was done using Video-otoscopy , Pure tone audiometry , Impedence audiometry , Diagnostic nasal endoscopy and in selected patients CT scan of Paranasal sinuses.

Patients in one group were managed conservatively by using antihistamines , nasal decongestants, topical steroids , and were asked to perform regular Valsalva manouvre . Patients in second group were treated by myringotomy and grommet insertion. Both the groups were followed up for 6 months by regular videootoscopy and pure tone audiometry for reversal or progression of retraction and improvement or worsening of hearing. The results were compared at first month , third month and sixth month postoperatively for significant difference between the two lines of management.

OBSERVATIONS AND RESULTS

From our study it was found out that there was definite improvement in the grade of tympanic membrane retraction and hearing thresholds by early intervention. During follow up examination for a period of 6 months ,there was definite improvement in the grade of tympanic membrane retractions by reversal of retraction pockets (86.9%) in group managed by grommet insertion with a definite improvement in hearing levels as suggested by reduction in air – bone gap in pure tone audiograms (87%). In the group of patients treated medically , there was reversal of retraction in 63.9 % of patients with improvement in hearing for 40.9% of patients. The results were analysed and compared using Chi-square testing and found to be statistically

significant suggesting that there is a definite advantage of myringotomy and grommet insertion over medical measures in the early management of retraction pockets of tympanic membrane.

CONCLUSION

From our study it was inferred that progression of retraction pockets was significantly reduced by early intervention whether it is in the form of medical measures or surgery. By comparing the efficacy of the two lines of management it was found out that surgically managed group showed better outcomes both with respect to the status of retraction as well as degree of hearing improvement. The incidence of complications following surgery was not much significant as compared to the favourable outcomes. Early intervention was shown to definitely arrest the progression of retraction pocket to cholesteatoma and thus a 'safe' ear to 'unsafe' ear. Thus we conclude that management of pars tensa retractions by myringotomy and grommet insertion is a safe, effective and simple procedure and should be always considered ahead of conservative medical management and extensive tympanoplasty in appropriate cases.

KEY WORDS

Pars tensa retraction pockets, myringotomy, grommet insertion, medical management.

INTRODUCTION

Middle ear is an organ that must maintain an aerated cavity within it for the fulfillment of its function of sound conduction. So to maintain its sound-conduction function at a high level, it has a double ventilation system, the Eustachian tube and transmucosal gas exchange. Any pathological processes affecting these two systems will result in hypoventilation of middle ear and initiates the formation of a sequence of events the precursor of which is a Retraction pocket.

A **Retraction pocket** is defined as a localized area of atelectasis of tympanic membrane in which there is indrawing of membrane forming an edge or margin. A retraction pocket can be in one or more of the four quadrants of the pars tensa, in pars flaccida , or both.[1]

Chronic otitis media is an inflammatory process in the middle ear space that may result in long term permanent changes in the tympanic membrane including atelectasis , perforation , tympanosclerosis , retraction pocket development or cholesteatoma.[2] Most accepted theory in the development of cholesteatoma is the Whittmack's theory or the Invagination theory[3], which states that the initiating factor in the production of cholesteatoma is functional obstruction of Eustachian tube , leading to impaired middle ear and mastoid ventilation. Under the

influence of fluctuating or sustained negative middle ear pressure the tympanic membrane becomes flaccid and produces retraction pocket. As retraction occurs , associated middle ear inflammation leads to adhesive otitis media. As retraction pocket enlarges medially & posteriorly , continued desquamation leads to accumulation of keratin debris and cholesteatoma formation.

So Retraction pockets secondary to Eustachian tube dysfunction is being considered as a precursor of cholesteatoma. Early intervention can be in the form of medical management which includes antihistamines , nasal decongestants, mucolytics , topical steroids , and doing Valsalva manouvre. Alternatively the reversal of retraction pocket can be accomplished by insertion of ventilation tubes which helps in improving middle ear ventilation and reversal of retraction.[4]

This study was conducted to evaluate and compare the efficacy of early management of pars tensa retraction pockets by grommet insertion and by medical management and to know whether early intervention could stop the progression of retraction to cholesteatoma.

AIMS AND OBJECTIVES

1. To find out whether early intervention of retraction pockets can prevent progression to cholesteatoma.

2. To compare the efficacy of myringotomy and grommet insertion and medical measures in the management of pars tensa retraction pockets.

REVIEW OF LITERATURE

Retractions of tympanic membrane constitute a major proportion of ear diseases which causes concern to the otologists. The clinical features with which the patients presents also vary greatly from a completely symptomless retraction to a complicated one with the presence of cholesteatoma. Also surgical management of retraction pockets of tympanic membrane is still controversial. In patients with no predisposing cause , the course cannot be predicted. In some patients it progresses towards cholesteatoma & in some it remains asymptomatic. Hence dilemma arises in surgically managing the retraction pockets as the hearing acuity remains normal until later in the disease course & we are not able to predict the course towards cholesteatoma.

Retraction pockets are localized areas of tympanic membrane atelectasis occurring as an invagination of tympanic membrane into middle ear space. Retractions are known by various names such as atelectatic otitis , adhesive otitis , myringomalacia and middle ear epidermatisation. Most commonly used term “atelectasis” comes from Greek word “ateles” which means incomplete and

“etasis” meaning extension or ballooning . It is classified as a type of chronic otitis media which results from long term eustachian tube dysfunction with a poorly aerated middle ear .

Chronic otitis media can be classified according to **Nadol JB** et al as follows [5,6] which describes retraction pockets as a subtype of chronic otitis media.

1. Chronic active otitis media- subdivided into

   With cholesteatoma

   Without cholestaetoma

2. Chronic inactive otitis media- subdivided into

   With perforation

   With retraction pocket

   Adhesive otitis media

   With ossicular fixation or resorption

3. Chronic inactive otitis media with frequent reactivation

Classification of chronic otitis media according to **Browning** also describes retraction pockets as a subclass of COM. [7,8]

1. Healed COM (Tympanosclerosis , healed perforation)
2. Inactive mucosal COM (perforation)
3. Inactive squamosal COM (***Retraction***)
4. Active mucosal COM
5. Active squamous COM (Cholesteatoma)

Retraction pockets can be fixed when it is adherent to the structures of middle ear or it can be free when it is mobile medially or laterally according to the state of inflation of middle ear.

A more advanced type of retraction is Epidermization[9] which refers to replacement of middle ear mucosa by keratinizing squamous epithelium with no retention of keratin debris. It can involve part or whole of middle ear cavity. It often remains quiescent and does not progress to cholesteatoma or active suppuration. Therefore epidermisation itself is not an indication for surgical intervention.

Retraction pockets can occur in the pars tensa or pars flaccida. These two parts are histologically different from each other.

The pars tensa has both circular and radial collagenous fibres that are well organized and are relatively thick [10.] The posterior part of the pars tensa has a thinner lamina propria than in the anterior part and it has also increased vascular supply. The lamina propria in this region has sparse collagen fibres. This increased vascular supply makes it more prone to damage from inflammatory processes .These changes will disrupt the collagenous fibres and makes this region more prone for retraction.[11]

Pars flaccida has a thin lamina propria and the collagenous fibres are thinner , less organized and more sparsely distributed in the ground substance. The structural differences in the tympanic membrane in the pars flaccida causes it to be more prone to retraction. [12] The lack of fibrocartilaginous ring at the Notch of Rivinus also contributes to the inherent weakness of pars flaccida. Luntz[13] stated that pars flaccida retractions are more common than pars tensa retractions due to the above mentioned reasons.

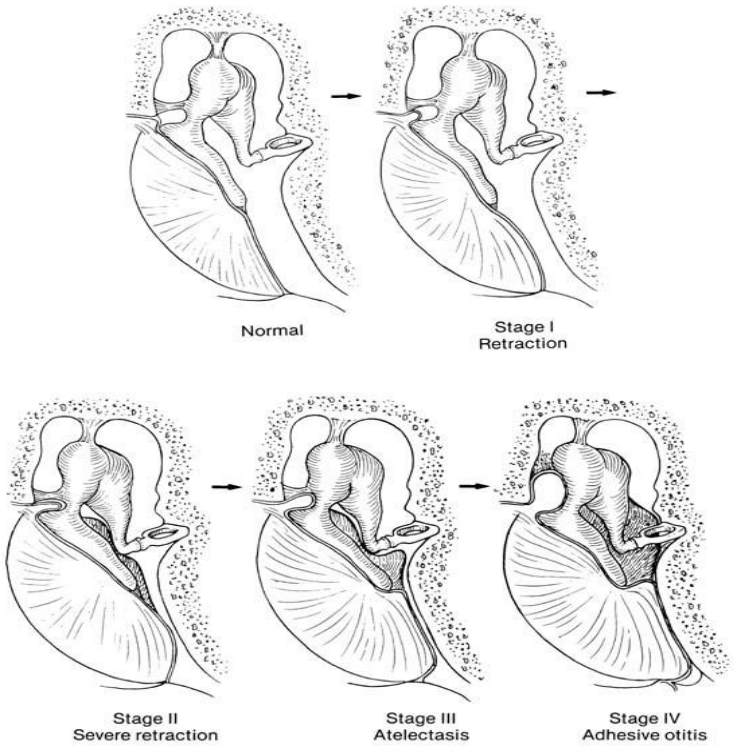
Pars tensa retraction pockets usually occur in the posterior tympanic membrane. They are classified according to their degree by **Sade and Berco**[14]

Grade 1 - tympanic membrane is retracted but does not touch any middle ear structures.

Grade 2 – tympanic membrane is retracted and touches the incus or stapes

Grade 3 - tympanic membrane is retracted and touches the promontory

Grade 4 - tympanic membrane is retracted around the edges of scutum and is adhered to middle ear structures and is not mobile



. FIG.NO.1.RETRACTION STAGES

Dornhoffer [15] in 2000 described a classification system for pars tensa retraction pockets which was similar to Sade's but differed in the representation of grade four retractions. Sade does not comment in his classification whether the drum is entirely seen or not. Dornhoffer on

the other hand is more concentrating on the aspect that whole of drum can be visualized adequately. So Dornhoffer staging describes Grade 4 as drum touching the promontory and retracted around a corner so that all aspects of drum are not visible. Dornhoffer staging is nowadays more accepted as visualizing all aspects of the drum is more important than its adhesive properties. Sade also gives a Grade 5 atelectatic ear as an ear that perforates spontaneously.

Pars flaccida retractions are graded according to **Tos et al**[16]

1. Stage 1 - pars flaccida is dimpled and more retracted than normal but not adherent to the malleus
2. Stage 2 - the retraction is adherent to the neck of malleus and the full extent of the retraction can be seen
3. Stage 3 - part of the retraction is out of view and there may be partial erosion of the bony attic wall
4. Stage 4 - there is definite erosion of the attic wall with the full extent of the retraction being uncertain

So in both types of retraction the main underlying causative factor is sustained and prolonged negative middle ear pressure secondary to chronic Eustachian tube dysfunction.

Various other authors have also classified severity of Retraction pockets like Borgstein et al, Yung et al, and Characon et

al. Many of them have classified retractions according to the criteria like mobility of tympanic membrane, adherence to promontory, adherence to osssicles or presence or absence of cholesteatoma.

ETIOLOGY OF RETRACTION POCKETS

Eustachian tube dysfunction is considered to be the most important contributor in the pathogenesis of chronic retraction. It was first suggested by Politzer more than 100 years ago.[17] Many of the patients with otitis media and related conditions have Eustachian tube dysfunction that may induce secondary mucosal disease of middle ear such as inflammation[18.] . Infection can occur from reflux,or aspiration of nasopharyngeal contents back up the eustachian tube and into the middle ear. Inflammation secondary to infection or allergy may result in mechanical obstruction of Eustachian tube. In addition to this some patients have mucosal disease due to allergy or more rarely primary ciliary dyskinesia due to Kartagener's syndrome.

Other factors contributing in addition to above are as follows

- Chronic nasal obstruction

- Adenoids
- Cranio-facial malformations
- Base of skull tumors or trauma
- Otitic Barotrauma
- Disorders of tensor veli palatini

RELEVANT ANATOMY AND PHYSIOLOGY

EUSTACHIAN TUBE

Eustachian tube is a dynamic channel that forms a communication between the middle ear and the nasopharynx.

EMBRYONIC DEVELOPMENT

The Eustachian tube and the middle ear develops as an outpouching of the pharynx that forms the tubotympanum and the pneumatised temporal bone.[23] The cartilaginous part undergoes majority of development in utero. During development the Eustachian tube provides a continuous sheet of epithelial cells to create middle ear lining. [24] One difference in the development of middle ear mucosa and eustcahian tube mucosa is that the epithelium of Eustachian tube develops into respiratory epithelium ie pseudo stratified columnar epithelium while middle ear mucosa does

not. This distinction provides a more effective , inherent, protective component.

ANATOMY

In adults the eustachian tube is about 36 mm in length. This is reached at the age of 7 years. It runs downwards , forwards and medially from the middle ear at about 45 degree angle. The lateral one third is bony and medial two thirds is cartilaginous. The intervening narrowest part is the isthumus. The tube is lined with respiratory mucosa containing goblet cells and mucous glands . At the nasopharyngeal end the mucosa is truly respiratory but at the middle ear end the tube has less of goblet cells and cilia.

The bony part is 12mm in length . It runs through the petrous and squamous parts of temporal bone, gradually tapering to the isthumus where the diameter is only 0.5mm or less. Superiorly is the tensor tympani muscle and medially is the carotid canal.

The cartilaginous part is 24 mm in length and consist of fibrocartilaginous skeleton to which the peritubal muscles are attached. The cartilage is situated in a groove between the petrous temporal bone and greater wing of sphenoid which terminates near the root of medial pterygoid plate. The posteromedial wall is

composed of cartilage and anterolateral wall of cartilage and fibrous tissue . the medial end of the cartilage projects into the nasopharynx under the mucosa to form Torus tubarius. The tube opens 1-1.25 cm behind the posterior end of inferior turbinate. Behind the torus is the Pharyngeal recess or Fossa of Rosenmuller. Lymphoid tissue is present around the tubal orifice and the fossa of Rosenmuller and may be prominent in childhood.

MUSCLES ATTACHED TO EUSTACHIAN TUBE

Four muscles are attached to the eustachian tube.

The Tensor veli palatini muscle is the primary dilator of the tube. It has 3 origins . First is at the base of medial pterygoid plate on the scaphoid fossa. The second is from the spina angularis of the sphenoid and third from the lateral wall of the cartilaginous tube. Insertion is on to the tendon at the pterygoid hamulus.[25]

Levator veli palatini is a thicker muscle . it lies lateral to tensor palate. Originates from 2 sites. The first is the inferior surface of petrous temporal bone. The second is the medial lamina of cartilaginous tube. The muscle extends above the superior pharyngeal constrictor to join with its counterpart on opposite side.[26]

Salpingopharyngeus originates from the inferior portion of Eustachian tube and extends downwards to join the pharyngopalatinous muscle . it assists in elevation of pharynx and opening of tube with deglutition.

Tensor tympani originates from 3 portions. First from the cartilaginous portion of Eustachian tube , second from the greater wing of sphenoid and third from the bony canal in which the muscle travels. It hooks around processus cochleariformis goes and inserts into the manubrium of malleus.

The ascending pharyngeal and middle meningeal arteries supply the Eustachian tube. The veins drain into the pharyngeal plexus and lymphatics into the retropharyngeal nodes. The nerve supply arises from the pharyngeal branch of sphenopalatine ganglion (Vb) for the ostium, the nervus spinosus (Vc) for the cartilaginous part, and from the tympanic plexus (IX) for the bony part.

Normally the Eustachian tube stays closed and opens when necessary to equalize pressure. Other functions include clearance of middle ear fluid and preventing nasopharyngeal secretions refluxing into middle ear space.

INFANT VERSUS ADULT ANATOMY

The anatomical differences of eustachian tube in adults and infants are related to the higher incidence of middle ear diseases in infancy and childhood. These differences contribute to less effective active tubal opening mechanism in children

ANATOMIC FEATURES OF EUSTACHIAN TUBE	**IN THE INFANT, AS COMPARED WITH ADULT , IT IS**
Length of the tube	shorter
Angle of the tube	10 A^0 vs 45 A^0
Angle of tensor veli palatine muscle to cartilage	Variable vs Stable
Cartilage cell density	Greater
Lumen	Smaller area
Mucosal folds	Greater
Ostmann pad of fat	Wider
Cartilage volume & middle ear volume	Less
Elastin at hinge portion of cartilage	Less

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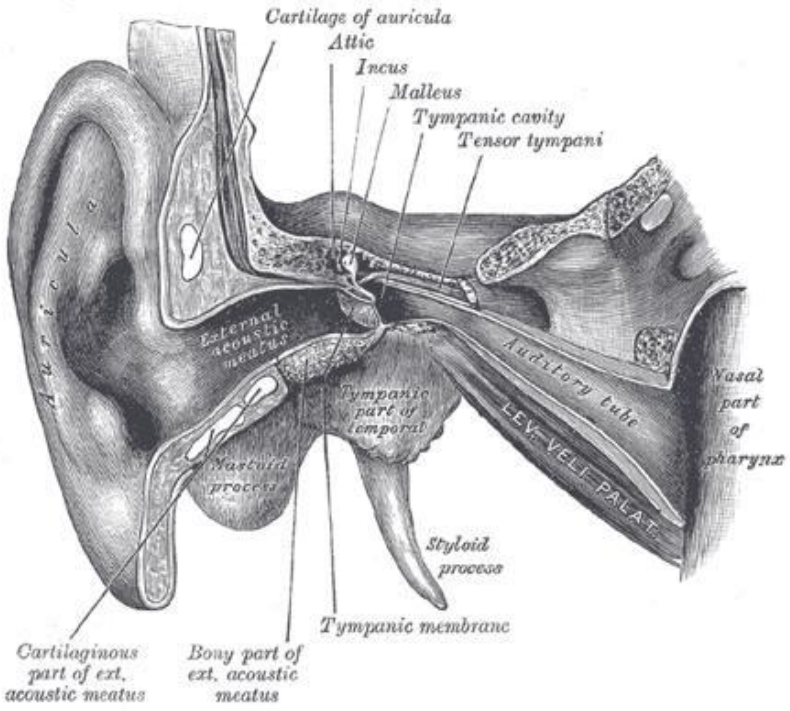
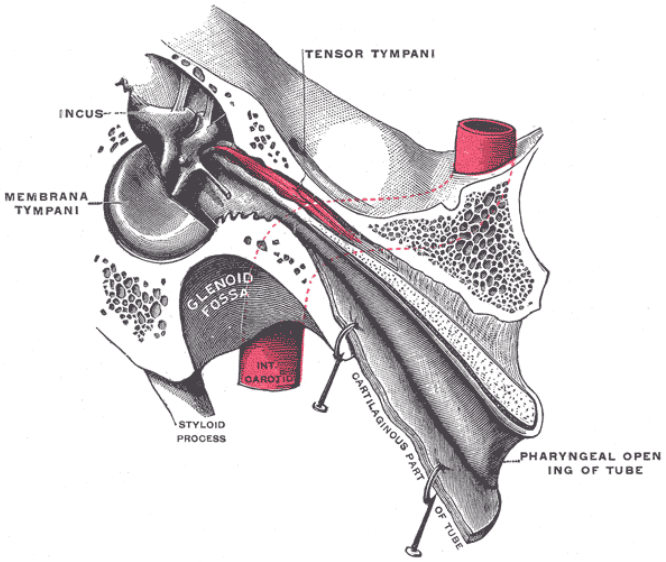
FIG.NO.2.ANATOMY OF EUSTACHIAN TUBE





PHYSIOLOGY OF EUSTACHIAN TUBE

Three physiologic functions of eustachian tube include

1. Ventilation of the middle ear that will equalize middle ear gas pressure with the atmospheric pressure.
2. Protection of middle ear from nasopharyngeal secretions
3. Clearance of secretions from the middle ear into the nasopharynx

- **VENTILATION OR PRESSURE REGULATION OF MIDDLE EAR**

Normally the eustachian tube is collapsed at rest probably due to slight resting negative middle ear pressure. It usually opens on swallowing and yawning due to the action of tensor veli palatine muscle action. The role of levator palati is uncertain. Repeated active opening of the tube maintains the normal middle ear pressure between +50mm to -50mm of H_2O. About 1 mL of air is absorbed from the middle ear in a single day. The mastoid air cell system is assumed as the gas reservoir for the middle ear.

- **PROTECTION OF MIDDLE EAR**

The eustachian tube normally drains the middle ear secretions into the nasopharynx and it also protects the middle ear from reflux of nasopharyngeal secretions. Any derangement of this protection as occurs in patulous eustachian tube will produce middle ear disease. Also in conditions which disturbs the closed middle ear system like tympanic membrane perforation or after mastoid surgery there will be tubal dysfunction leading to reflux of nasopharyngeal secretions. Forceful noseblowing, & laryngopharyngeal refux disease (LPRD) are also indicated now as other causes.

Conversely in air travel or in scuba diving , there develops a relatively high negative middle ear pressure which leads to stagnation of secretions in the middle ear which inturn leads to middle ear effusion or otitic barotrauma. Valsalva manouvre or politzerisation may help to improve the condition.

The local immunologic defense of respiratory epithelium of the eustachian tube, and its mucociliary clearance play role in the protection of middle ear. Some protective function is also provided by a pulmonary immunoreactive surfactant protein isolated from the middle ears of animals and humans.

- **CLEARANCE OF MIDDLE EAR SECRETIONS**

Clearance of secretions from the middle ear is by the mucociliary action of the tubal epithelium and the middle ear mucosa. Also it is by the muscular action of the tube and surface tension within the tube lumen.

For explaining the clearance function better Bluestone et al introduced a flask model of system in which the nasopharyngeal end of the tube is considered as the mouth of the flask , the isthumus as the narrow neck and the middle ear and mastoid air cell system as the body of the flask. Fluid flow through the neck depends on the following factors

- pressure at the two ends of the tube
- the radius and length of isthumus
- The viscosity of the secretions

But one drawback for this is it does not signifies the role of the tensor veli palatine in opening the nasopharyngeal end of the tube.

CONSEQUENCES OF TUBAL DYSFUNCTION

The sequelae of chronic tubal dysfunction may be

1. Early retraction of tympanic membrane
2. Sterile transudation in the middle ear from the hyperaemic mucosa of the middle ear and consequent to O_2 and N_2 absorption. (ex-vacuo theory)
3. Development of adhesive otitis media

   Ojala in 1953 proposed 3 stages in the progression of disease

   1. An acute stage (OTOSALPINGITIS) characterized by tubal obstruction and inflammation in the middle ear causing mucosal damage and fibrin exudates.
   2. An intermediate stage in which there is organization of exudates and adhesions formation. Mucosal lining of middle ear and mastoid will be edematous with exudates having cholesterol crystals. Connective tissue fills the mastoid air cells with surrounding bony sclerosis.
   3. Terminal stage showing mature fibrous adhesions. Aeration of mastoid air cells will be decreased. Also bone resorption may be there especially for long process of incus. The commonest sites of adhesions seems to be the oval & round windows ,Prussak's space, ossicles , and epitympanum.

PATHOGENESIS

The 3 main mechanisms that regulate middle ear pressure are

1. Gas diffusion through the middle ear mucosa
2. Pressure buffer of the mastoid air cell system
3. Gas exchange through the Eustachian tube

1.**MUCOSAL RESPIRATION**

Gas exchange in middle ear is similar to that in the lung. The direction of gas exchange is according to the differences in partial pressure of the component gases in the middle ear cleft and mucosa. Also the inflammatory processes will affect thickness and blood flow of the middle ear . They also have direct effect on rate of diffusion. When mucosa is healthy, oxygen and nitrogen are absorbed equally by the mucosa as is the rate of expulsion of carbon di oxide. [28, 29.] If the mucosa is inflamed , vascularity is more and there is increased absorption of gases.[30,31]

Gas exchange also does not occur uniformly in whole of middle ear. Epithelium near the antrum is richly vascular. Hence it is here around the antrum that most of the gas exchange occurs.[32]

Fluctuations in the blood flow according to body position have significant effect on the respiratory or diffusion rate.[33, 34.] Sade and

luntz examined a series of patients who had complete atelectasis of tympanic membrane[35]. Results showed that one half had inflated middle ear spaces within one minute of awakening from sleep. After they were upright, tympanic membranes quickly reverted back to their atelectatic positions.

2. **MASTOID VOLUME AND PRESSURE**

Most series show correlation between lack of mastoid aeration and middle ear disease. This relationship is based on Boyle's law which states that at a constant temperature, pressure multiplied by volume equals a constant (P X V = C). That is pressure and volume are inversely related.

Hence small mastoid volumes causes greater changes in pressure. The volume of mastoid plays a significant role in middle ear compliance and the resultant forces imparted on the tympanic membrane.[36, 37.] So fluctuations in middle ear pressure in presence of a small mastoid cavity will result in greater forces applied to tympanic membrane when compared to the same pressure changes in a larger more aerated mastoid.

Mastoid aeration also increases the mucosal surface area. This increased surface area causes increase in the respiratory properties of middle ear and increases the gas exchange through the mastoid mucosa.[38, 39].

3.**EUSTACHIAN TUBE FUNCTION**

Normally the Eustachian tube is closed and opens only when the tensor palate contracts. When the tube opens the volume of gas exchange is around 1 microL with every swallow in nondiseased ears. In most cases of atelectatic ears the Eustachian tube is hypofunctional. This decrease in function leads to a proportional decrease in middle ear ventilation resulting in middle ear negative pressure which causes absorption of nitrogen from air in the middle ear cleft.

A hyper functional Eustachian tube can also cause middle ear atelectasis. Patients with this condition often sniffs to create a negative pressure and voluntarily close their Eustachian tube. This sniffing can lead to middle ear atelectasis. [40]

SEQUELAE AND PROGRESSION OF RETRACTION POCKETS

The main problem with retraction pockets is the dilemma that

whether the retraction will progress , remain static or resolve. They may reach a size and configuration that they no longer become self-cleansing and accumulate inactive squamous debris. This debris becomes infected and then the disease is characterized by repeated episodes of discharge, with symptom free intervals in between which is termed as intermittently active squamous COM. There is evidence that tympanic retraction can behave in this way, but distinguishing those ears that will progress from those that will remain stable is not possible. Consequently, regular follow up is advised.

Retractions also produces histological changes in the tympanic membrane so that perforation can occur in addition to ossicular erosion most commonly the long process of incus.

There is evidence that pars tensa retractions in children is a dymanic process that most often resolves spontaneously in 70% cases[41.] But

· Charachon,[42] in a study of adults and children (*n* = 95) of stage 1 and 2 (Charachon classification) tympanic retractions followed up over a period of five years found that 16 percent deteriorated to stage 3 (follow up 82 %) and underwent surgery. So the rate of progression of retraction pockets to cholesteatoma is still a matter of conflict. Bluestone et al reported on

the progression to cholesteatoma describing how acquired cholesteatoma can develop.[43]

The sequence of events include

Eustachian tube dysfunction

Negative middle ear pressure

Tympanic membrane Atelectasis

Retraction in the attic or posterosuperior region

Adhesive Otitis Media

HISTOLOGICAL STUDY OF PARS TENSA RETRACTION POCKETS

The histological findings that are found in pars tensa

retraction pockets:

(1) subepithelial chronic inflammation seen in 86% of cases

(2) loss of middle double collagen layer & the inner mucosal layer

(3) proliferation & hyperkeratinization of the outer epithelial layer

(4) epithelial cones with proliferating cells in basal epithelial layer

Universal finding among all grades were inflammation and cellular proliferation.Basal epithelial cones, middle collagen layer and inner mucosal layer loss were found to be increasing with increasing grades of retraction. Progressive histological features similar to cholesteatoma was noted with increasing grades of retraction (II-IV). Breach of the basement membrane is reported as a feature of cholesteatoma but not of retraction.

MANAGEMENT OF RETRACTION POCKETS

EVALUATION OF THE EUSTACHIAN TUBE

Assessment is started initially by history taking thoroughly. Typically theses patients complain of fullness of ears, pain or discomfort, hearing loss , tinnitus, and dizziness and these symptoms are typically not relived by swallowing, yawning or chewing.

PHYSICAL EXAMINATION

The grade of tympanic membrane retraction is assessed by otoscopic examination. The mobility of drum is evaluated by pneumatic otoscopy. .Stiffness or middle ear effusions are suggestive of Eustachian tube dysfunction. Indirect nasopharyngoscopy or diagnostic nasal endoscopy using a 30^0 or 70^0 Hopkins rod endoscope is done to visualize the posterior nasopharynx and proximal opening of Eustachian tube. Pathology such as adenoid hypertrophy or mucosal edema can be seen. A flexible fibreoptic 0.8mm scope is used to evaluate beyond the isthumus of tube or upto the middle ear cleft.

EUSTACHIAN TUBE TESTING

There are objective and subjective assessments helpful in studying Eustachian tube dysfunction.When the tympanic membrane is intact, the microflow technique[44-48] or an impedance method [49] (both of which require a pressure chamber), sonotubometry, sequential scintigraphy[50,51],

microendoscopy, or directly inserting a balloon catheter into the cartilaginous

Eustachian tube may be used. When the tympanic membrane is not intact, the

forced-response test may be used. Sonotubometry[52-56] is currently in use in

routine research studies but is not available for clinical use. A new

measurement of Eustachian tube mechanical properties using a modified

forced-response test[57] is currently being tested in animals and humans.

Kumazawa and colleagues devised the tubotympanoaerodynamic graphy[58]

(with Valsalva's maneuver), which is employed when the tympanic

membrane is intact or not.

Classic Tests

Prior to 1960s, most tests of the pressure regulation function of the

Eustachian tube were only assessments of the tubal patency. The classic

methods of Valsalva, Politzer, and Toynbee for assessing the Eustachian

tube are still in use today, as is catheterization of the Eustachian tube. But

of these tests, the Toynbee provides some insight into the patient's

Eustachian tube regulatory function. These tests are traditionally used when

the tympanic membrane is intact, but some are used when the eardrum is

not intact, such as Valsalva's test.

In **VALSALVA TEST** patient holds their nose

and blows out with a closed mouth. **TOYNBEE TEST** is in a similar manner in which the patients hold their nose and swallow. While they swallow Examiner visually inspects the tympanic membrane and evaluate for movement.A positive pressure is created in the nasopharynx, followed by a negative pressure phase. The test is considered positive when there is alteration in the middle-ear pressure. This is assessed by pneumatic otoscopy before and after the manouvre. Negative middle ear pressure or temporary fall in the middle ear pressure followed by return to normal ambient pressure is suggestive of normal Eustachian tube function.[59]

In the **POLITZER TEST**, one of the patient's nostrils is occluded with a rubber balloon.Then the examiner pinches the other nostril tightly. The patient lifts the palate up by swallowing or phonating. The examiner drives air into the closed nasal cavity from a Politzer's bag. Air can be heard going into the middle space with an auscultation device. The examiner also compares the tympanic membrane visually before and after the procedure to determine its relative patency.[60]

EUSTACHIAN TUBE CATHETERIZATION

Eustachian tube catheterization with curved metal tip transnasally has been used to assess tubal function even more than 100 years ago itself. the catheterization was done as a blind procedure before the endoscopy era and the way to confirm the position of catheter was posterior

rhinoscopy. With the advent of nasal endoscopes ,it is done under endoscopic guidance.

The catheter is passed along the floor of the nose in the side usually opposite to any septal deviation. The catheter is advanced till it reaches posterior wall of the nasopharynx.It is then rotated medially to an angle of 90^0 and is pulled anteriorly till it impinges on the posterior free end of nasal septum and then rotated 180° laterally. Now the tip lies at the nasopharyngeal opening of the Eustachian tube. The other end of the catheter is attached to a Politzer bag, and an auscultation tube with 2 ear tips is used. One tip is kept in the patient's ear and the other in examiner's ear. Air is then pumped into the catheter by Politzer bag. The examiner hears the rush of air when it travels through the catheter into the eustachian tube and hence into the middle ear.

If the applied positive pressure is transferred normally from the proximal end of the cannula into the middle ear tubal patency is ensured. Normal blowing sounds indicates patent Eustachian tube and bubbling means middle ear fluid. Whistling usually indicates partial Eustachian tube obstruction and absence of sounds implicates complete obstruction or failed catheterization.

TYMPANOMETRY

Tympanometry alone is a useful screening tool in the investigation of Eustachian tube dysfunction. The main advantages include ease to use , highly reproducible results and is well tolerated by even young children. It measures the compliance of middle ear transformer mechanism and provides an objective assessment of the status of middle ear. A peak of maximal compliance is obtained when the pressure in the external canal equals that of middle ear. This is the principle of tympanometry . By varying the pressure in the external canal, it is able to state the status of middle ear. When pressures between the middle ear space and ear canal are equal , a normal Type A curve is obtained[61]. If there is negative middle ear pressure it results in a Type C curve with compliance peak being at less than -99 da Pa. If there is an effusion then the compliance does not vary with changes in canal pressures and a flat Type B curve is obtained. They can be classified in a number of ways the simplest being peaked or non peaked , usually with the additional subclass of peaked depending on the pressure at which the peak is recorded.

TYPE OF TYMPANOGRAM	DESCRIPTION
PEAKED	
A	Between +200 and -99 da pa
C_1	Between -100 and -199 da pa
C_2	Between -200 and -399 da pa
NON PEAKED	
B	No observable peak between +200 and -600 da pa

SONOTUBOMETERY

A final testing is sonotubometery. In this procedure, a sound source is applied to the nostril as a microphone in the external canal records the transmitted sounds. Sound levels are measured as the Eustachian tube closes and opens. The advantage of this method is that it can evaluate the Eustachian tube inspite of whether or not tympanic membrane is intact or not under physiologic conditions.[62]

MANAGEMENT can be medical or surgical

MEDICAL MANAGEMENT

Atelectasis of middle ear requires usually no active treatment , if it is of short duration, which is usually encountered during an upper respiratory infection or during a short allergy season. Most often it is due to the inflammation compromising the lumen of Eustachian tube mostly in persons who have an underlying , pre-existing obstruction of the tube. During these periods , the acute atelectasis will be self-limited and the middle ear will return to normal pressures once the inflammation subsides. No specific treatment should be directed toward the middle ear unless the patient has complaints like severe otalgia , hearing impairment , tinnitus, or vertigo. Treatment at this time should be directed at the relief of nasal symptoms. Topical or systemic nasal decongestants is usually used. This may relieve the congestion of Eustachian tube. If the symptoms are severe as when atelectasis is secondary to barotrauma myringotomy and tympanostomy tube placement may be necessary to relieve symptoms. Thus watchful waiting is recommended when Eustachian tube dysfunction is of short duration.

If atelectasis progresses to the chronic stage , a thorough search must be made for an underlying pathology like adenoid hypertrophy, nasal allergy, or paranasal sinusitis. If none are found , the management options

are either watchful waiting or active intervention. The decision for or against treatment is based on the presence or absence of other assosciated symptoms and whether there is abnormal negative middle ear pressure. The symptoms like persistent otalgia , hearing loss , vertigo , or tinnitus troublesome to the patient requires active treatment. For chronic atelectasis in such cases , a trial with a topical or systemic nasal decongestants with or without antihistamines are helpful. Cantekin and colleagues in 1980 found that children without an upper respiratory infection had lower closing pressure of Eustachian tube afer taking decongestant – antihistamine combination compared with their control group. So in presence of normal mucosa , this study confirmed their effect on Eustachian tube function.[63]

Dexamethasone also has showed promising results. Silverstein and coworkers [64] showed that direct treatment of Eustachian tube with dexamethasone has beneficial effects. This requires a pressure equalization tube to be placed first and the medication is applied transtympanically. Shapiro and colleagues [65] showed increased benefit in achieving normal middle ear pressure and tympanic membrane mobility by using aerosolized nasal dexamethasone. But there is a concern on cortisol levels which can be lowered in some patients. Tracy and colleagues [66] found that intranasal beclomethasone may be useful adjunct to prophylactic antibiotic

treatment . More rapid improvement is seen in the first 8 weeks of treatment.

The treatment of symptomatic Eustachian tube dysfunction by inflation of Eustachian tube and middle ear is of uncertain benefit. Valsalva's or Politzer's methods are being advocated when negative middle ear effusion is present.[67] But these methods will not return the middle-ear pressures to normal for a prolonged period when Eustachian tube is functionally obstructed.[68] Inflation of Eustachian tube and middle ear may provide temporary relief of atelectasis where no effusion is present, but it is suggested to repeat the procedure for permanent control of symptoms and to maintain drum in a more normal position . Yung used nasal continuous positive airway pressure in patients with atelectasis and reported short term benefits.[69] Luntz and Sade also inflated the middle ear with either air or nitrogen upto 5 consecutive days and found only short term benefits and that Tympanic membrane returned to former atelectatic position with in 15 minutes to 5 hours following inflation.[7]

SURGICAL MANAGEMENT

Surgery may be indicated when a chronic retraction pocket or total atelectasis is present and nonsurgical methods have failed.

MYRINGOTOMY AND TYMPANOSTOMY TUBE PLACEMENT

Insertion of pressure equalization tubes had been the mainstay of surgical treatment for retraction. Myringotomy and tympanostomy tube insertion makes the middle ear pressure ambient and restore the tympanic membrane to more normal anatomic position. This bypasses the dysfunctional Eustachian tube. This surgical procedure is usually performed to prevent possible irreversible changes in the middle ear. The tympanic membrane in the area of retraction pocket should return to neutral position within several weeks to months. van Heerbeek[71] and coworkers identified changes to the Eustachian tube seen in the form of passive tubal function as observed by significant increase in the opening pressures as compared to preoperative measurements.

If the retraction remains adherent to the ossicles, the middle ear , or both , adhesive otitis media is present and tympanoplasty should be considered to prevent further progression to ossicular discontinuity, cholesteatoma formation, or both. To prevent recurrence of retraction or total atelectasis in addition to tympanostomy tube insertion, a portion of pinna cartilage is placed over the affected area. Blaney and colleagues reported success in managing retraction pockets by simple excision of the pocket and placing the tympanostomy tubes.[72]

When a flaccid tympanic membrane is partially collapsed on the ossicles and middle ear and high negative middle-ear pressure is not present , the Eustachian tube function has improved , the tympanic membrane remains abnormal. In such cases tympanostomy tube insertion may not be useful as membrane is not actively being retracted by high negative middle ear pressure. At this stage adhesive otitis media may also be present and portions of tympanic membrane may be adherent to medial portions of middle ear. The posterior or epitympanic portions may become separated from anterior portion by adhesions. So ventilation from Eustachian tube or a tympanostomy tube does not aerate the affected area. In such cases Tympanoplasty is the next step.

TYMPANOPLASTY

It is indicated in selected cases of retraction where chronic atelectasis is present.

Main indications[73] include

- The extent of the retraction is not fully visible with otomicroscope

- Inability to expand the pocket using the Bruening otoscope , with nonmagnifying lens and otomicroscope
- Failure to expand the retraction during nitrous oxide anesthesia
- Retraction fails to return to normal position 2 to 4 weeks following the insertion of a tympanostomy tube placed in another
- Recurrent or chronic infection within pocket
- Difficulty in determining whether a cholesteatoma is present

The most compelling indication for tympanoplasty is considered as a deep retraction pocket in the postersuperior portion of pars tensa or pars flaccid that is unresponsive to nonsurgical methods and insertion of tympanostomy tubes. So if even after a month or so after the placement of tympanostomy tubes ,the retraction pockets did not return to the neutral position, Tympanoplasty should be considered. There is high incidence of necrosis of incus or formation of cholesteatoma if they are left behind. It is usually done under general anesthesia where nitrous oxide is used as anesthetic agents. The retraction pocket if it gets elevated , insertion of tympanostomy tube will usually be sufficient to prevent recurrence of retraction pocket. A thorough examination of retraction pocket should be performed to determine the extent of the pocket. In addition, the continuity of incus and stapes should be assessed because of erosion of long

process of the incus may require surgical correction. A tympanostomy tube must be inserted at the time of tympanoplasty and should be reinserted if atelectasis begins to recur after the tube is extruded spontaneously.

CARTILAGE GRAFT TYMPANOPLASTY

All patients especially children for whom tympanoplasty was done for severe atelectasis should be followed at relatively frequent intervals for the first year and at appropriate intervals for succeeding years as recurrence of atelectasis should be anticipated. To prevent recurrence a cartilage tympanoplasty is usually done. Tragal or conchal cartilage is used to cover the area of retraction pocket particularly in the attic or posterosuperior region. The cartilage "batten" prevents the recurrence of the retraction pocket and subsequent cholesteatoma. Instead of cartilage a **silicone sheet** can also be used which prevents postoperative adhesions in the epitympanum and mastoid. This contributes considerably to recovery of mastoid aeration.

FULDAER VENTILATION SURGERY performed by Kaftan and Draft [74] in 2000 combined various methods to improve ventilation of middle ear. The procedures performed are Mastoidectomy, Posterior Tympanotomy , and Removal of incus and head of the malleus with an interposition of the incus. The tympanic membrane is reconstructed with a cartilage – perichondrial graft , a tube was placed into the middle ear orifice leading

to nasopharynx (Wright-Tube). Approximately 26% of patients who did not respond to other modalities responded to this procedure. Also some researchers have gained similar results in preventing recurrent cholesteatoma in patients with Eustachian tube dysfunction by mastoid and epitympanic obliteration alone. [75] Mastoid obliteration has shown promising results in preventing recurrent disease due to malfunctioning of Eustachian tube by eliminating the potential space for development.[76]

LASER EUSTACHIAN TUBOPLASTY

One of the few procedures that are used to treat proximal dysfunction of Eustachian tube is LASER Eustachian Tuboplasty. This was originally proposed by Kujawski and Poe[77] provides a means to treat intractable Eustachian tube dysfunction. A CO_2 or 980 nm diode laser was used to obliterate mucosa and cartilage from the luminal posterior wall of the tube. Success rate was reported to be 66% with this method.

ADENOIDECTOMY

Adenoidectomy for Eustachian tube dysfunction is a controversial topic. Bluestone et al[78] in 1975 found out that children with adenoid hypertrophy and problems with proximal opening of Eustachian

tube , showed some benefit after adenoidectomy in active opening and closure of the tube.

VENTILATION TUBES

Ventilation tubes are placed in the tympanic membrane for treatment and prevention of otitis media and related complications. Other synonyms used are Tympanostomy tubes, pressure equalizing tubes (PE tubes) , and grommets. The use of ventilation tubes was first suggested by Adam Politzer about a century ago in 1883[79]. The reintroduction of these tubes was by Armstrong in 1954[80]. Since then they have become immensely popular and Paradise[81] estimated the worldwide insertion rate to be 2 million annually.

CHOICE OF VENTILATING TUBE

A wide range of ventilating tubes are now available.

1. MATERIALS

For all purposes the material should ideally be completely smooth and inert. This reduces the tendency of lumen to get blocked by blood or secretions. Tubes made of Teflon , silicone, and stainless steel are superior

in this respect to polyethylene. They are also available with an ultra-thin carbon coating.

2. DESIGN

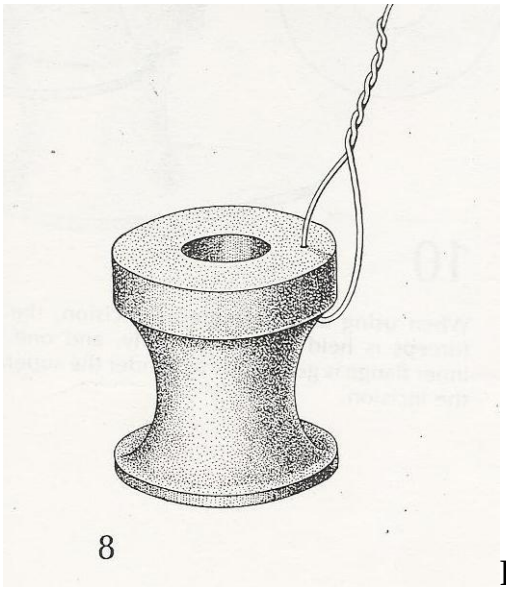
A large number of designs have evolved in an attempt to solve the problems of premature extrusion and blockage of the lumen. Design of the tube determines the technique of insertion.

TYPES OF VENTILATING TUBES

There are THREE types of ventilating tubes : short-term (in place for 6-8 months) , intermediate tubes (for 8-15 months) long-term tubes (for more than 15 months) . Tubes are placed in the pars tensa of the tympanic membrane in any location usually in the anterinferior quadrant. Usually they are not placed in the posterosuperior quadrant which overlies the incus and stapes.

SHORT TERM VENTILATION TUBES

One of the older designs and still one of the most popular is the **SHEPARD TUBE** . It is available in Teflon or silicone with an attached stainless steel wire or an integral tail of the same material which can be cut short as required.



8 FIG.NO.3.SHEPARD TUBE

Another tube which is used for short term ventilation is **DONALDSON'S TUBE**. The main problem with these tubes are that they tend to be extruded more rapidly ie 45% within 6 months[82]. Their use is indicated when the need for medium or long-term ventilation is not expected for example for first attacks of SOM when tube insertion is combined with adenoidectomy. They are easy to insert and so useful if the external canal iv narrow.

MEDIUM – TERM VENTILATION

If ventilation for a year or two is considered desirable, for instance in patients with recurrent SOM, marked retraction pockets , or ciliary dysfunction , one of the following tubes may be selected.

SHAH GROMMET

It is made of Teflon and has an elongated inner flange. It easy to insert , as the narrow tip, of the almost triangular flange slips readily under the upper margin of the incision. The long flange helps to prevent extrusion . The extrusion may be further delayed if the tube is rotated so that the tip of the long flange points towards the malleus handle.

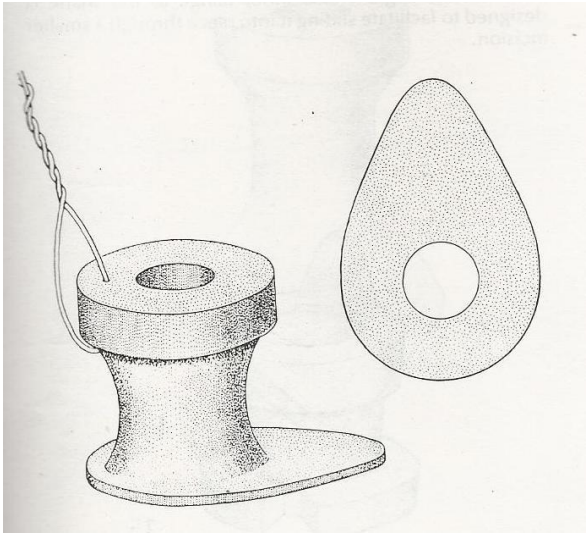


FIG.NO.4. SHAH GROMMET

REUTER BOBBIN

This tube is made of Teflon or stainless steel . it is available with a standard lumen of 1.1mm internal diameter and a larger lumen of 1.25mm, which is less liable to block especially as the tube is also of short length. The slightly wider thin flanges and 90^0 flange-to-tube angle help to resist extrusion. The holes in the flanges may allow tissue to grow into them , which would help to anchor the bobbin. The bobbin is

inserted by grasping it with very fine crocodile forceps between a flange hole and the outer edge of the flange. It is not as easy to insert as the short-term use.

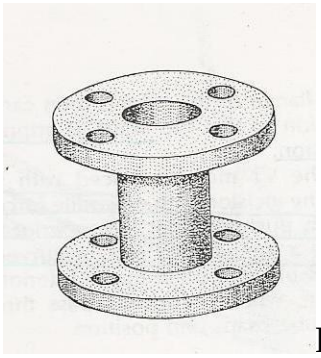


FIG. NO. 5 REUTER BOBBIN

PAPARELLA TYPE 1 TUBE

It is a soft silicone tube with a notched inner flange. It introduced by inserting one corner of the notch through the incision and then rotating the tube with a screwing movement until the whole flange has passed through the incision. The manoeuvre and the soft materials enables it to be passed through a smaller incision.

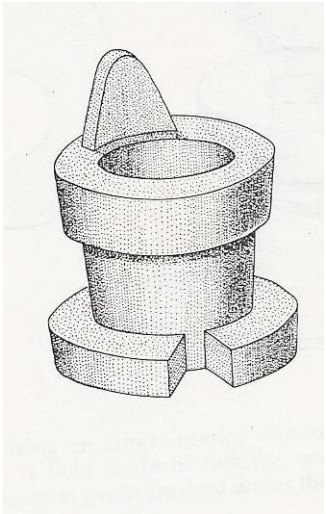


FIG NO.6 PAPERALLA TYPE 1 TUBE

ARMSTRONG BEVELLED TUBE

The Armstrong beveled tube is available in Teflon or silicone. The angle of the inner flange to the shank is designed to facilitate sliding it into place through a small incision.

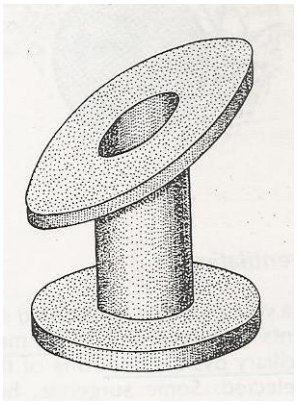


FIG. NO.7. ARMSTRONG BEVELLED TUBE

FEUERSTEIN SPLIT TUBE

The Feuerstein split tube (and the similar J.S. Knight split tube which has an elongated flange) diminishes the liability to blockage by reducing the length of the lumen.

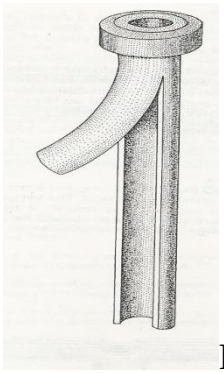


FIG. NO. 8.FEUERSTEIN SPLIT TUBE

LINDEMAN – SILVERSTEIN ARROW TUBE

It is available in Teflon and silicone. The widely flared inner increases anchorage and is slotted so that there is wide access to the lumen even if the tip touches the promontory. It is inserted with the flat surface of the arrow parallel to the incision.

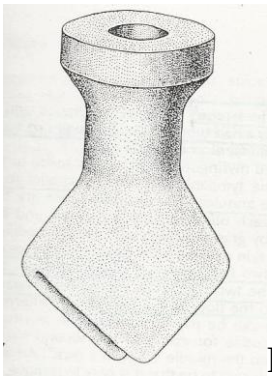


FIG. NO. 9. LINDEMAN-SILVERSTEIN ARROW TUBE

LONG TERM VENTILATION

This is usually done in very refractory cases of SOM in which there is recurrences of middle ear fluid and hearing impairment as soon as tube is extruded or blocked. Tubes designed for this purpose depend on large flanges as an anti-extrusion device, and some have a wider lumen to

diminish the tendency to blockage.

PER – LEE TUBE

It is made of silicone , has been found to be very effective in resisting extrusion. The very wide flange though bulky , is soft but may require a slightly larger myringotomy. Part of the flange should lie deep to the malleus. The flange and tube length can be trimmed as appropriate.

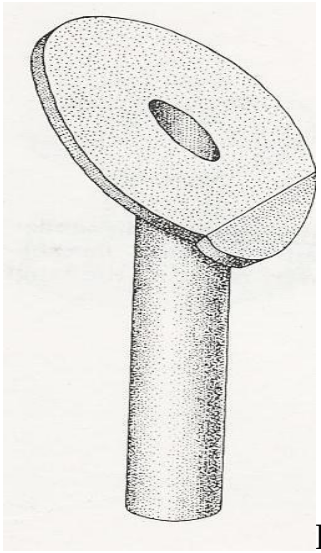


FIG. NO.10. PER-LEE TUBE

GOODE T –TUBE

It is made of silicone and its lumen opens into a half tube set at right angles to form a T. The method of insertion is as follows . A curved myringotomy incision is made in the inferior part of the tympanic membrane , parallel to and 2 mm above the annulus. The 2 half tubes are then folded towards each other to form a cylinder and held in this position by grasping them with fine crocodile forceps at their junction with the tube. Keeping them together in this way the two half tubes are passed through the myringotomy. The two half tubes are now

separate and lie parallel to the floor of the middle ear. Alternatively , one half tube can be passed through the myringotomy first with crocodile forceps, and the second half tube then folded into middle ear with a pick. An advantage of this tube is that is easy to remove , despite the large T-flanges , without a second myringotomy - the 2 half tubes collapse readily.

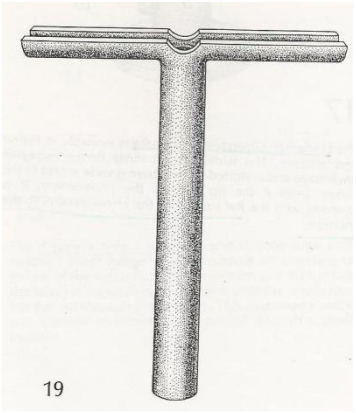


FIG.11.GOODE TUBE .

The Paparella type 2 and 3 tubes are similar to type1 and are made of soft silicone. They have larger lumens and wider flanges in order to resist blockage and extrusion.

POSTOPERATIVE FOLLOW UP AND CARE

TUBE APPEARANCE AND FUNCTION

Follow up examination is approximately 2 weeks after insertion.

Assessed by repeat audiogram and compared with the preoperative

hearing levels. If hearing has improved it is assumed that the tube is in

place and patent and functioning. The patient is then reexamined in 3 to 6

weeks and then every 3 to 4 months until spontaneous tube extrusion .

A tympanostomy tube is functioning properly

- if it spans the eardrum
- the tube lumen is patent
- no middle ear effusion is present.

Tube function is assessed by otoscopic examination which

includes pneumatic otoscopy or impedence audiometry.

On pneumatic otoscopy the normal eardrum should be

mobile, if the tube is in place it is not mobile and if there is no other

signs of middle ear effusion, the tube is probably functioning properly.

A flat tympanogram ie B curve with large volume indicates that the tube

is patent or there is a perforation elsewhere in the tympanic membrane. A

peaked tympanogram is found when the tube is obstructed or extruded

with a normal middle ear cavity (no effusion in the ear cavity) . A flat

tympanogram (B curve) with a small volume indicates a nonfunctioning

tube with a middle ear effusion .

Patients are advised to avoid water entering the ears as this may

cause middle ear infection . Thus swimming is best avoided .

COMPLICATIONS

Complications of Tympanostomy tube may be divided into two groups.

The first group includes early complications. Here the tube is in place

and patent and are related directly to the tube.

The second group includes late complications. Here the tube is extruded and may or may not be related to the tube.

Complications that can occur at the time of myringotomy include damage to incus , stapes , incudostapedial joint , facial nerve or chorda tympani if the incision is made posteriorly and too high. A rare complication is damage to jugular bulb, which is occasionally situated in the lower mesotympanum with a very thin wall.

According to the time of development of complications they can be divided into Early and Late complications.

Early Complications include purulent otorrhoea , tube blockage, premature extrusion , progressive hearing impairment and ossicular necrosis.

Late complications include persistent perforation after tube extrusion, hyaline degeneration of tympanic membrane , granuloma , cholesteatoma , tympanosclerosis, atrophy of tympanic membrane and migration of tube into middle ear.

MATERIALS AND METHODS

This study titled "An interventional study of Pars tensa retraction pockets - A comparison between grommet insertion and medical management" was done in the Department of Otorhinolaryngology, Coimbatore Medical College Hospital from September 2011 to Novenber 2012. Patients attending the outpatient department who had Pars tensa retraction pockets of grades II and III according to Sade's classification and having no predisposing nasopharyngeal and paranasal sinus pathologies were selected and divided randomly into two groups. Each group comprised 25 patients each. Pre operative evaluation was done using Video-otoscopy , Pure tone audiometry , Impedence audiometry , Diagnostic nasal endoscopy and in selected patients CT scan of Paranasal sinuses.

Patients in one group were managed conservatively by using antihistamines , nasal decongestants, topical steroids , and were asked to perform regular Valsalva manouvre . Patients in second group were treated by myringotomy and grommet insertion. Both the groups were followed up for 6 months by regular videootoscopy and pure tone audiometry for reversal or progression of retraction and improvement

or worsening of hearing. The results were compared at first month , third month and sixth month postoperatively for significant difference between the two lines of management.

PATIENT SELECTION

The study included 50 patients with their consent for participation in the study and they were divided into 2 groups of 25 patients each based on random selection.

INCLUSION CRITERIA

1. Patients with pars tensa retraction pockets grades II and III according to Sade's classification
2. Age group 10 – 60 years
3. Both sex
4. Without any predisposing nasopharyngeal and paranasal sinus pathology

EXCLUSION CRITERIA

1. Patients with pars tensa retraction pockets grades I and IV according to Sade's classification
2. Patients with pars flaccida retraction
3. Patients with retraction and obvious cholesteatoma or granulation

4. With any comorbid conditions like diabetes mellitus or any immunocompromised states.

METHODS

DETAILED HISTORY AND EXAMINATION OF PATIENTS

All patients included in the study were subjected to detailed history taking and examination pertaining to ear , nose and throat.

PRE OPERATIVE EVALUATION

All patients included in the study were examined and investigated by the following methods

Video otoscopy

Pure tone audiometry

Impedance audiometry

X Ray Mastoids

Diagnostic nasal endoscopy

CT scan of Paranasal sinuses (in selected patients)

Routine blood investigations (complete blood count, renal function tests)

Chest XRay , ECG (depending on age)

All patients who were planned for myringotomy and grommet insertion were assessed for general anesthesia.

After complete workup one group was taken up for surgical management by myringotomy and grommet insertion while the other group was advised conservative management by nasal decongestants , anti histamines , topical steroids and Valsalva manouvre. Both groups were followed up regularly at first , third and sixth month for progression or reversal of retraction pocket and improvement or deterioration of hearing .

PROCEDURE

Under general anesthesia , using orotracheal intubation patient put in position with head turned to the side opposite to that of surgery. After painting and sterile draping , ear canal washed with Povidone Iodine solution and thorough aural toileting done to remove any wax or squamous debris. Using a myringotome a radial incision was made at the anteroinferior quadrant and Shepard's grommet was inserted and secured in position.

OBSERVATIONS AND RESULTS

This study comprising of 50 patients was conducted in the Department of Otorhinolaryngolgy, Coimbatore Medical College Hospital from September 2011 to November 2012. All patients had pars tensa retraction pockets of grade II and III according to Sade's classification. Any nasopharyngeal or sinus pathologies were excluded by appropriate investigations. Preoperative videootoscopic findings, pure tone audiogram and impedence audiometry were recorded. One group was managed with myringotomy and grommet insertion and the other group was managed conservative methods like antihistamines , nasal decongestants, topical steroids , and were asked to perform regular Valsalva manouvre. All patients were followed up regularly at first, third and sixth months postoperatively and for progression or reversal of retraction pocket and improvement or deterioration of hearing. Observations that the study brought out are as follows. Group which was managed by Grommet insertion was assigned as Group A and that managed conservatively was assigned as Group B for convenience.

Out of the 50 patients, 2 patients in group A and 3 patients in Group B lost to followup . Hence they were excluded from the study. The rest of the patients were regularly followed up for progression or reversal of retraction by video otoscopy. Also

their hearing was assessed by pure tone audiogram for improvement or deterioration in air-bone gap. The results were compared and analysed using Chi square testing .

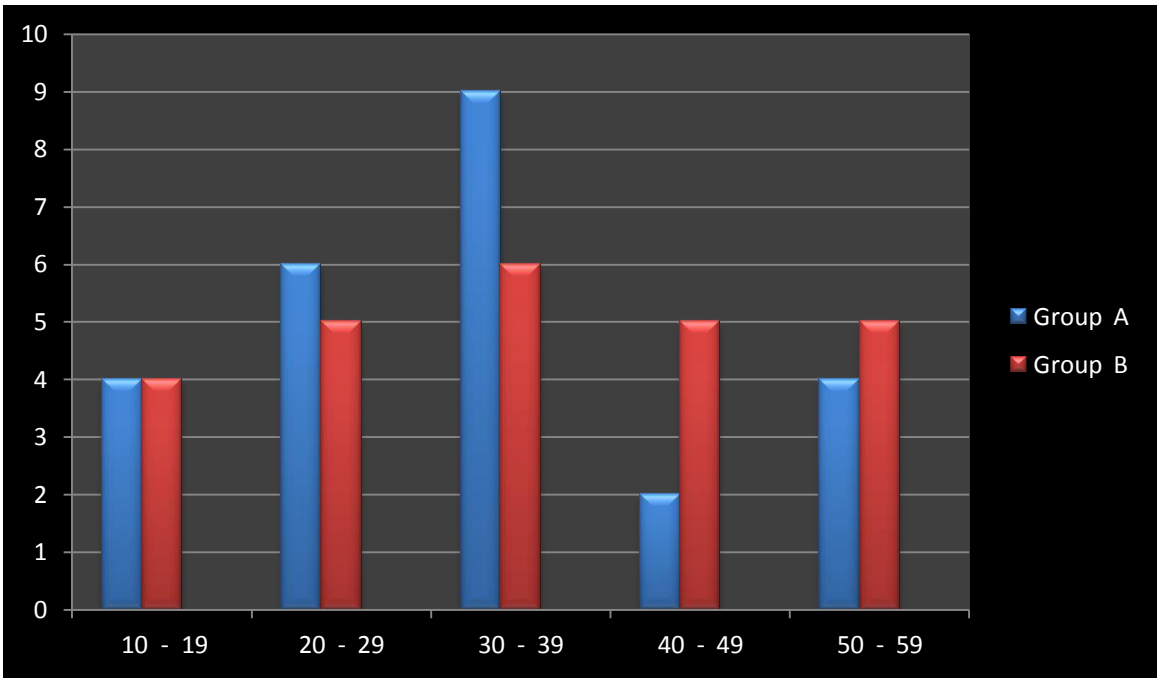
AGE DISTRIBUTION

Criterion for age of the patient to be included in the study was kept between 10 and 60 years. The age distribution in the study was as follows

Table No 1 : Age distribution amongst Group A and Group B

Age in years	Group A	Group B
10 - 19	4 (16%)	4 (16%)
20 – 29	6 (24%)	5 (20%)
30 - 39	9 (36%)	6 (24%)
40 - 49	2 (8 %)	5 (20%)
50 - 59	4 (16%)	5 (20%)
Total	25	25

Figure . 12 – Bar chart showing Age distribution in group A and group B

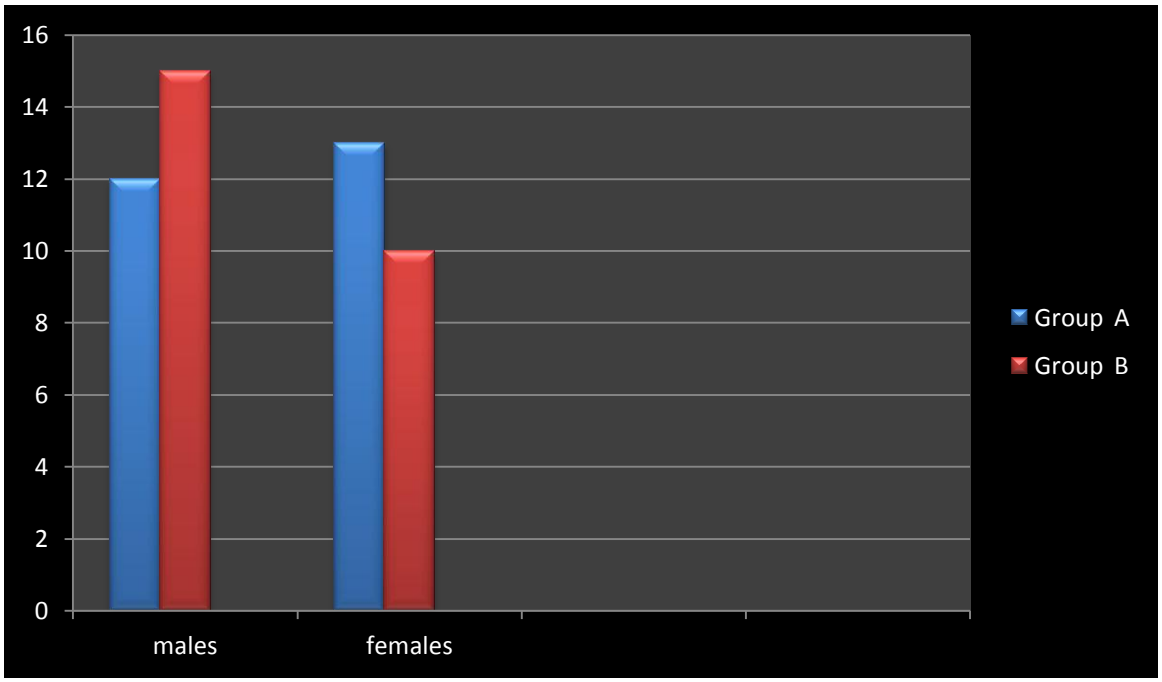


It is seen that the majority of patients were in the age group 30-39 years. Mean age of Group A was 32.68 years and that of group B was 30.8 years.

Table 2 – Gender distribution of Group A and Group B

SEX	GROUP A	GROUP B
Males	12 (48%)	15 (60%)
Females	13 (52%)	10 (40%)

Figure. 13 -Bar chart showing Gender distribution in Group A & Group B

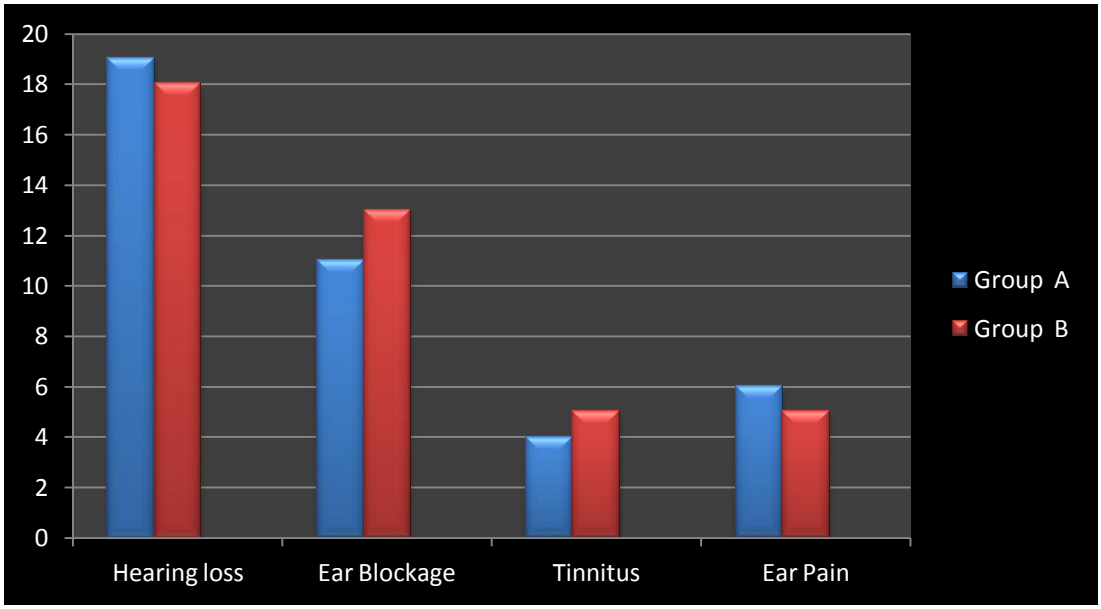


The total number of male patients in group A was 12 and in group B was 15. The total number of female patients in group A was 13 and in group B was 10.

Table 3 - Presenting Complaints in Group A and Group B

Presenting complaints	Group A	Group B
Hard of Hearing	19 (76%)	18 (72%)
Ear Blockage	11 (44%)	13 (52%)
Tinnitus	4 (16%)	5 (20%)
Ear Pain	6 (24%)	5 (20%)

Figure 14 – Bar chart showing the incidence of presenting complaints in group A and group B

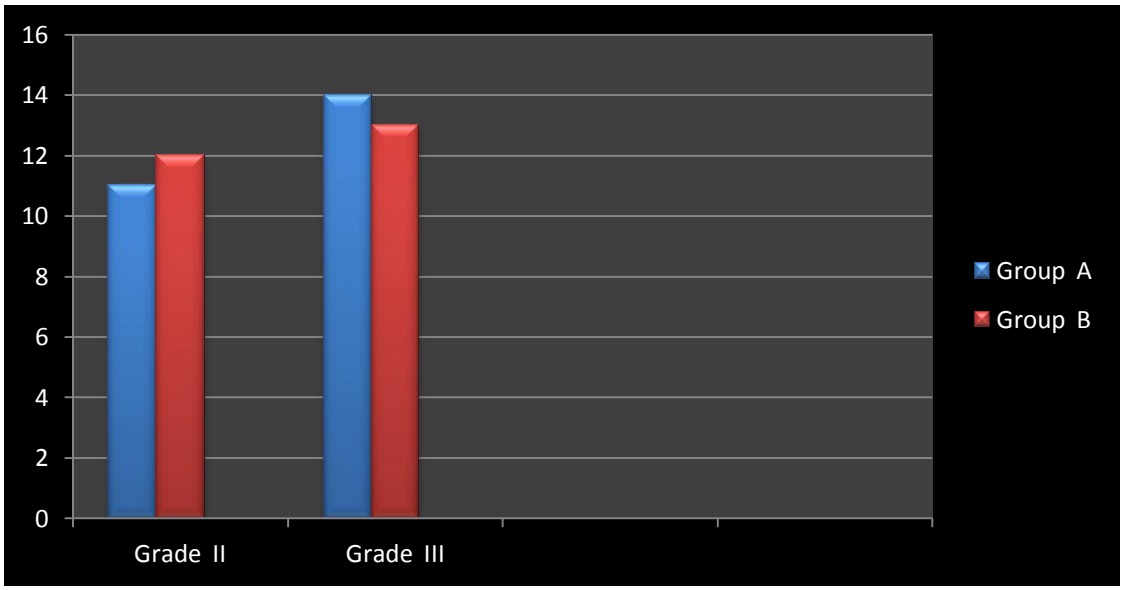


In both the groups most patients presented with hearing loss (76 % in group A and 72% in group B). Other frequent symptoms were ear blockage and tinnitus which were found in almost equal frequencies in both groups.

Table 4 – Grade of tympanic membrane retraction at the time of presentation (According to Sade's classification)

Grade of retraction	Group A	Group B
Grade II	11 (44 %)	12 (48%)
Grade III	14 (56%)	13 (52%)

Figure 15 – Bar chart showing the Grade of Tympanic membrane Retraction at the time of presentation in group A and group B

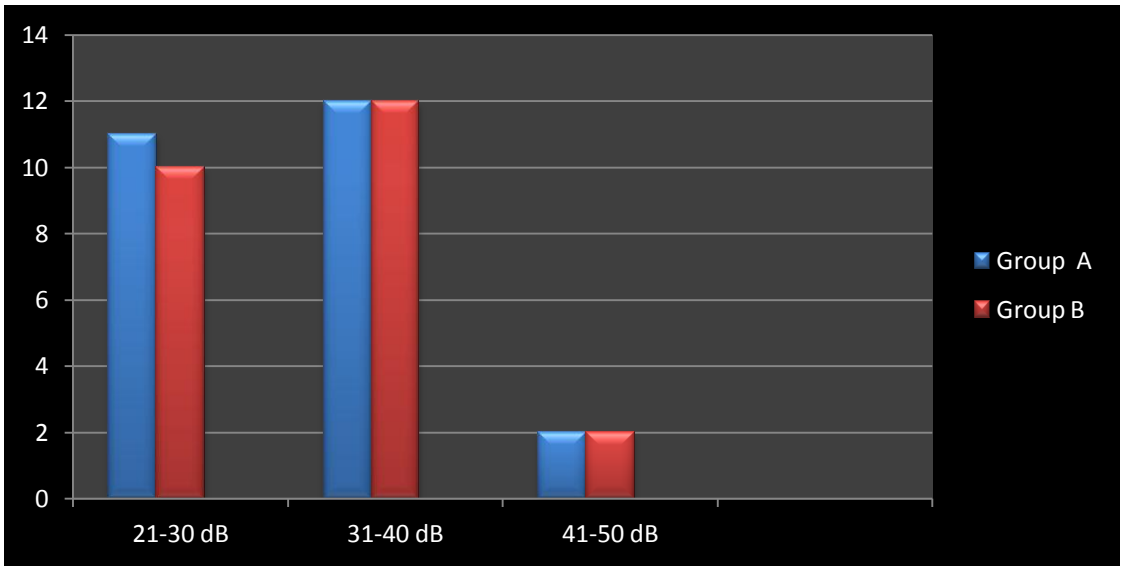


In group A ,11 patients had Grade II pars tensa retractions while in group B, 12 patients were having Grade II retractions. Similarly 14 had grade III retraction in Group A while 13 had Grade III retractions in group B.

Table 5 – Mean Air-Bone gap in Pure tone audiometry at presentation

Mean AB gap	Group A	Group B
21-30 dB	11 (44%)	10 (40%)
31-40 dB	12 (48%)	13 (52%)
41-50 dB	2 (8%)	2 (8%)

Figure 16– Bar chart showing the Mean Air-Bone gap at presentation in group A and group B

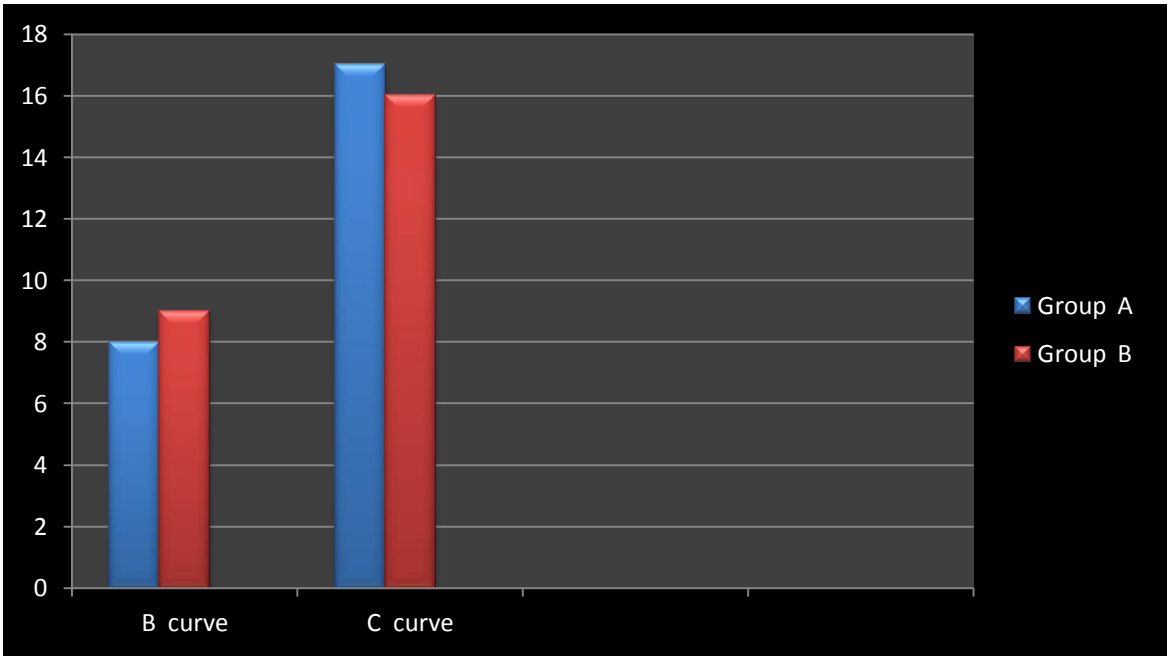


Most of the patients in both groups had mean Air-Bone gap in the range 31 to 40 dB (mild conductive hearing loss according to WHO classification) ie. 48% in Group A and 52% in Group B.

Table 6 - Impedance audiometry at Presentation

Type of Curve	Group A	Group B
B curve	8 (32%)	9 (36%)
C curve	17 (68%)	16 (64%)

Figure 17 – Bar chart showing the Impedance Audiometry at presentation in group A and group B

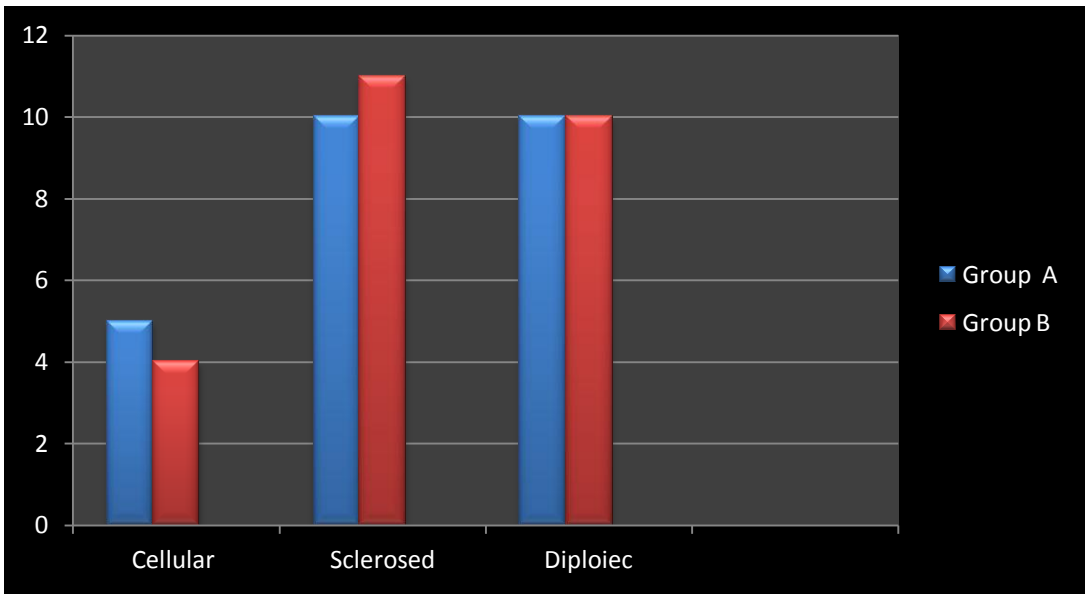


In both the groups the predominant type of curve was C type indicating the high incidence of negative middle ear pressure as the predominant pathology in the middle ear.

Table 7- Type of Pnuematisation of mastoid

Type of Pneumatisation	Group A	Group B
Cellular	5 (20%)	4 (16%)
Sclerosed	10(40%)	11(44%)
Diploiec	10(40%)	10 (40%)
Total	25	25

Figure 18 – Bar chart showing the Type of Pnuematisation of mastoid in group A and group B



It is observed that in both groups , the mastoids were sclerosed or diploiec in majority of cases. ie. a total of 80 % in Group A and 84 % in Group B. This indicates that a poor cellularity of mastoids has correlation with poor middle ear ventilation and hence the formation of retraction pocket.

Out of the 50 patients, 2 patients in group A and 3 patients in Group B were lost to followup . Hence they were excluded from the study. The rest of the patients were regularly followed up for progression or reversal of retraction by video otoscopy. Also their hearing was assessed by pure tone audiogram for improvement or deterioration in air-bone gap. The results were compared and analysed using Chi square testing .

Table 8- Videootoscopic appearance of the status of retraction pockets

in Group A (Total 23 Patients) during follow up

Status of retraction	1st month		3rd month		6th month	
	Grade II	Grade III	Grade II	Grade III	Grade II	GradeIII
Reversal of Retraction	4	5	4	6	6	5
Retraction remaining static	5	7	4	6	3	6
Progression of Retraction	1	1	2	1	1	2

Improvement in the Status of Retraction at the end of study – Total -20 patients - Includes →

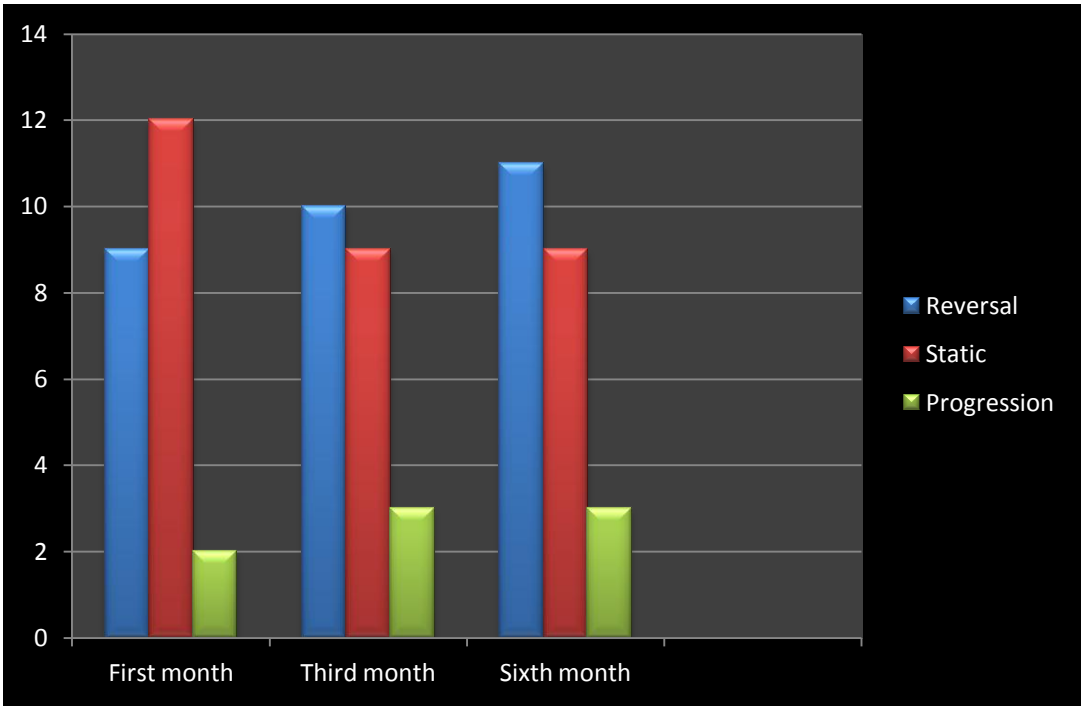
1. **Reversal of retraction (at the end of 6 months) – 11 patients (47.8%)**

2. **Retraction remaining static and not progressing (at the end of 6 months) - 9 patients (39.1%)**

Worsening of Retraction – 3 patients

- **Retraction Progressing(at the end of 6 months) – 3 patients (13.1%)**

Figure 19 – Bar chart showing the Video otoscopic appearance of status of retraction in group A during follow up



As it is observed improvement of retraction occurred in 20(86.9 %) out of 23 patients who were treated by myringotomy and grommet insertion with more of Grade III retractions progressing or remaining static than Grade II. Out of the 3 (13.1%) patients for whom results were poor, 1 had grommet extruded and had persistent retraction and 2 had persistent retractions with grommet in situ.

Table 9- - Videootoscopic appearance of the status of retraction pockets in Group B (Total 22 patients) during follow up

Status of retraction	1st month		3rd month		6th	
	Grade II	Grade III	Grade II	Grade III	month Grade II	GradeIII
Reversal of Retraction	1	0	2	1	2	1
Retraction remaining static	6	9	5	6	6	5
Progression of Retraction	4	2	5	3	2	6

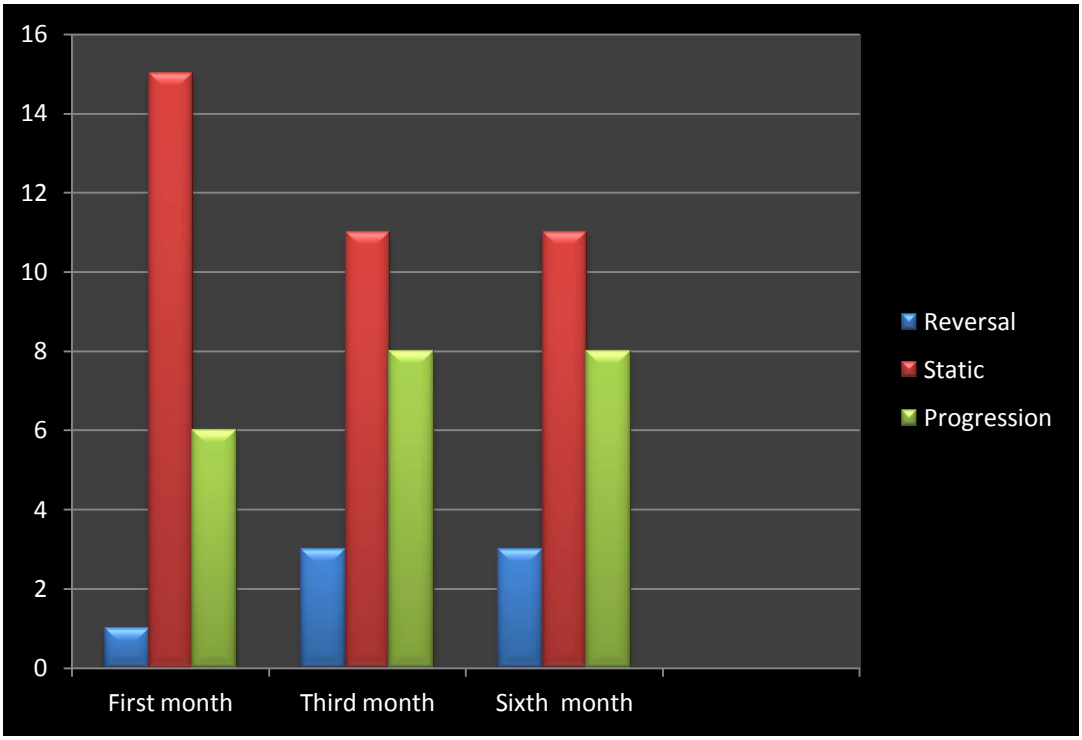
Improvement in the Status of Retraction at the end of study – Total 14 patients – Includes →

1. **Reversal of retraction(at the end of 6 months) – 3 patients (13.6%)**
2. **Retraction remaining static and not progressing (at the end of 6 months) -11 patients (50%)**

Worsening of Retraction at the end of study - 8 patients

- **Retraction Progressing (at the end of 6 months) – 8 patients (36.4%)**

Figure 20 – Bar chart showing the Video otoscopic appearance of status of retraction in group B during follow up

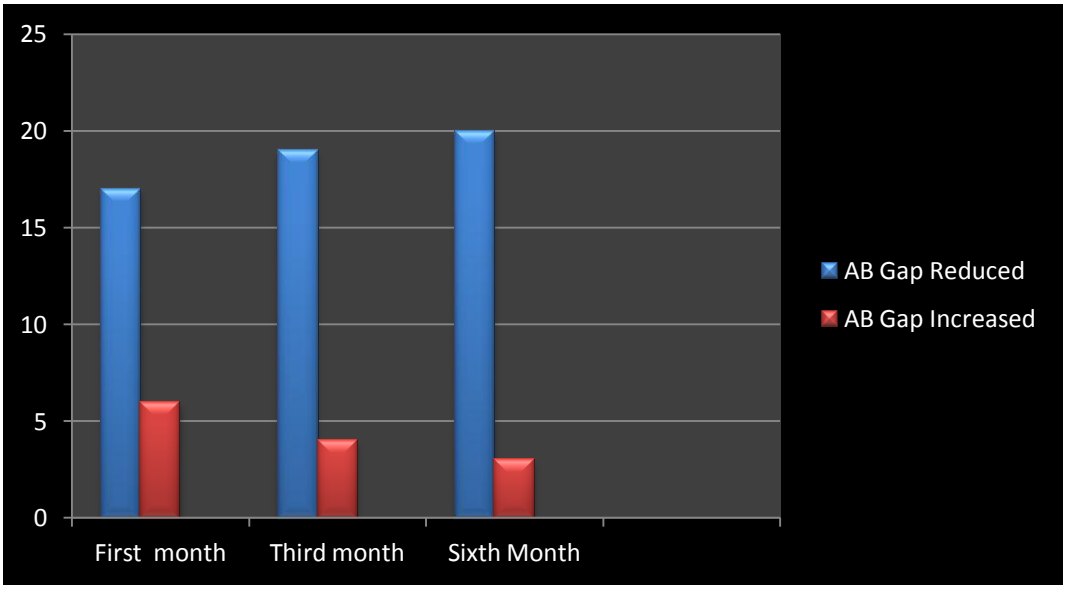


As is seen from the graph , there was a steady improvement in retraction grades with medical management. But only 14(63.6%) of patients responded to medical management . The rest 8(36.4%) had progressing retractions at the end of 6 months.

Table 10 – Follow up pure tone audiogram in Group A

Air-Bone gap	1st month	3rd month	6th month
Reduced or remaining static(Hearing improved)	17	19	20(86.9%)
Increased(Hearing Worsened)	6	4	3(13.1%)

Figure 21 – Bar chart showing the Follow up pure tone audiogram group A

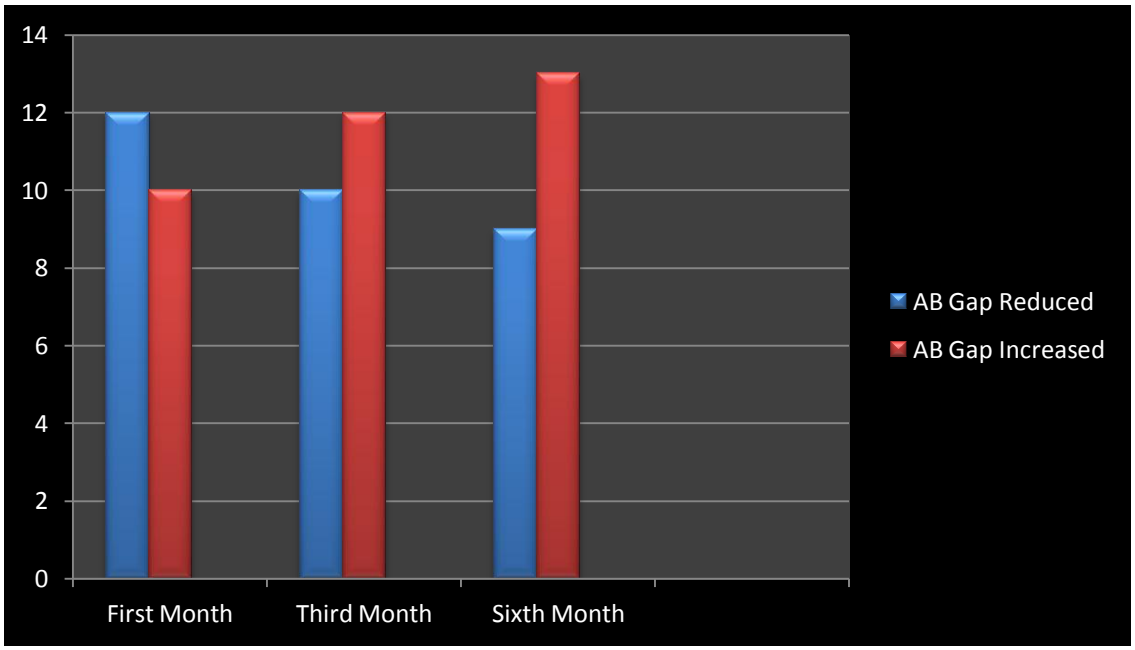


It is clearly seen that there is definite improvement in hearing thresholds in patients treated with grommet insertion. Of the 23 patients 20(86.9%) patients had hearing improvement by the end of six months.

Table 11 - Follow up pure tone audiogram in Group B

Air-Bone gap	1st month	3rd month	6th month
Reduced or remaining static(Hearing Improved)	**12**	**10**	**9(40.1%)**
Increased(Hearing Worsened)	**10**	**12**	**13(59.1%)**

Figure 22 – Bar chart showing the follow up pure tone audiogram group B

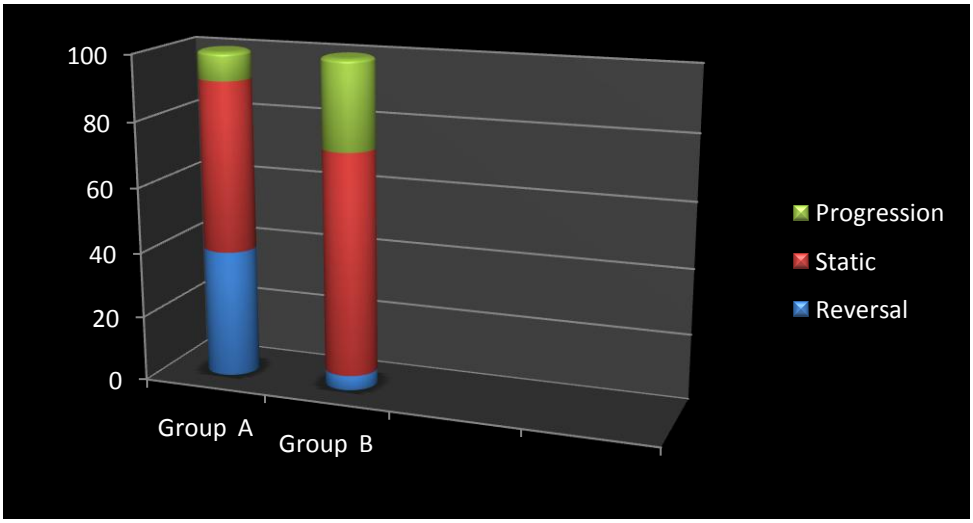


Only 9 patients out of 22 ie 41% responded to medical management as compared to 87 % in the group managed by grommet insertion.

Table 12- Comparison of the status of retraction between Group A and Group B at 1st month

Status of retraction	Group A	Group B	Total
Reversal of retraction	9 (39.1%)	1(4.5%)	10
Retraction static	12(52.2%)	15 (68.2%)	27
Retraction Progressing	2 (8.7%)	6 (27.3%)	8
Total	23	22	45

Figure 23- Bar chart showing Comparison of the status of retraction between Group A and Group B at 1st month



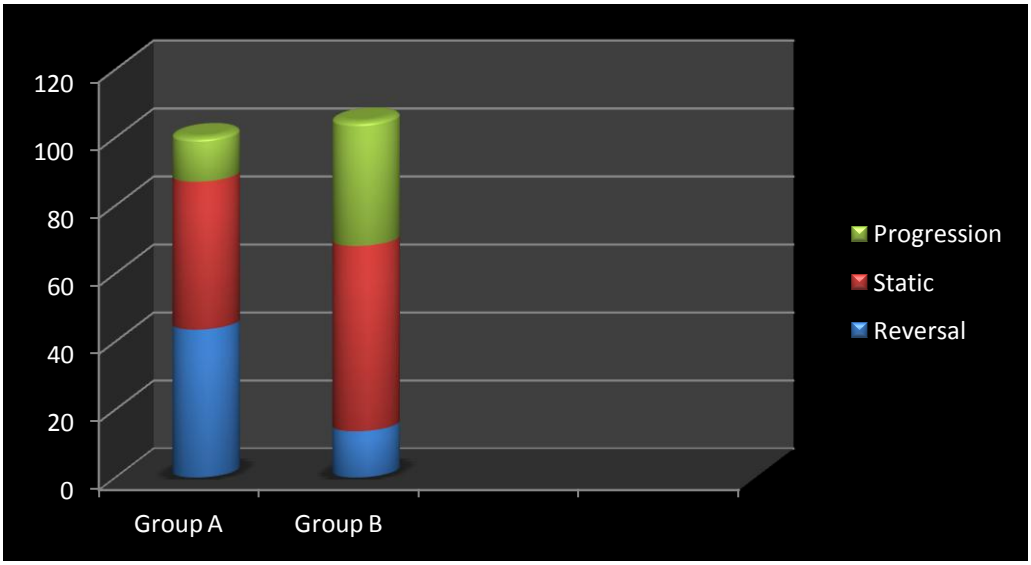
CHI-SQUARE TOTAL = 8.76 ,Degrees of Freedom = (3-1) X (2-1) = 2

P Value < 0.05 -Statistically significant

Table 13- Comparison of the status of retraction between Group A and Group B at 3rd month

Status of retraction	Group A	Group B	Total
Reversal of retraction	10(43.5%)	3(13.6%)	13
Retraction static	10(43.5%)	11 (54.5%)	21
Retraction Progressing	3 (13.1%)	8(36.6%)	11
Total	23	22	45

Figure 24- Bar chart showing Comparison of the status of retraction between Group A and Group B at 3rd month



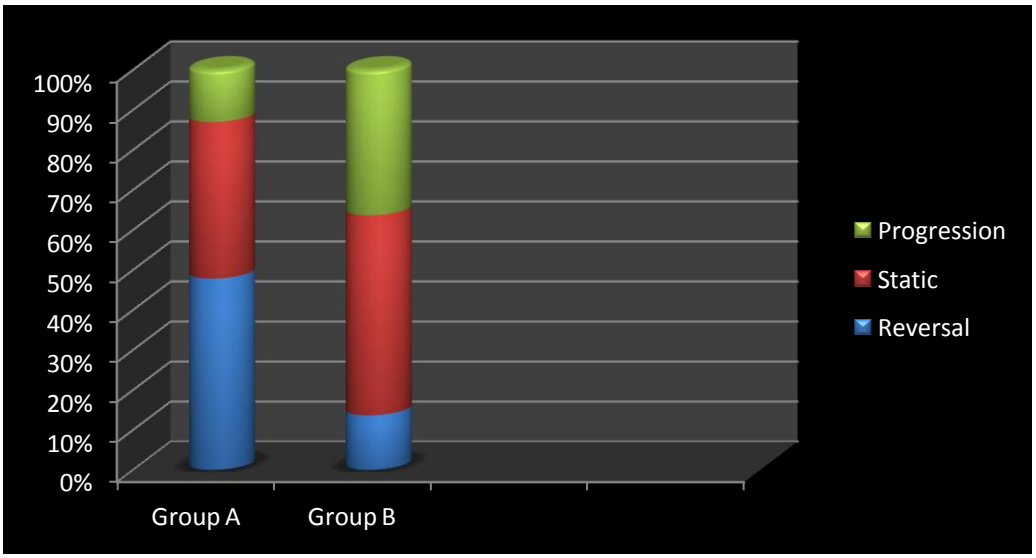
CHI-SQUARE TOTAL = 6.18 , Degrees of Freedom = (3-1) X (2-1) = 2

P Value < 0.05 -Statistically Significant

Table 14- Comparison of the status of retraction between Group A and Group B at 6th month

Status of retraction	Group A	Group B	Total
Reversal of retraction	11(47.8%)	3(13.6%)	14
Retraction static	9(39.1%)	11 (50%)	20
Retraction Progressing	3(13.1%)	8(36.4%)	11
Total	23	22	45

Figure 25- Bar chart showing Comparison of the status of retraction between Group A and Group B at 6th month



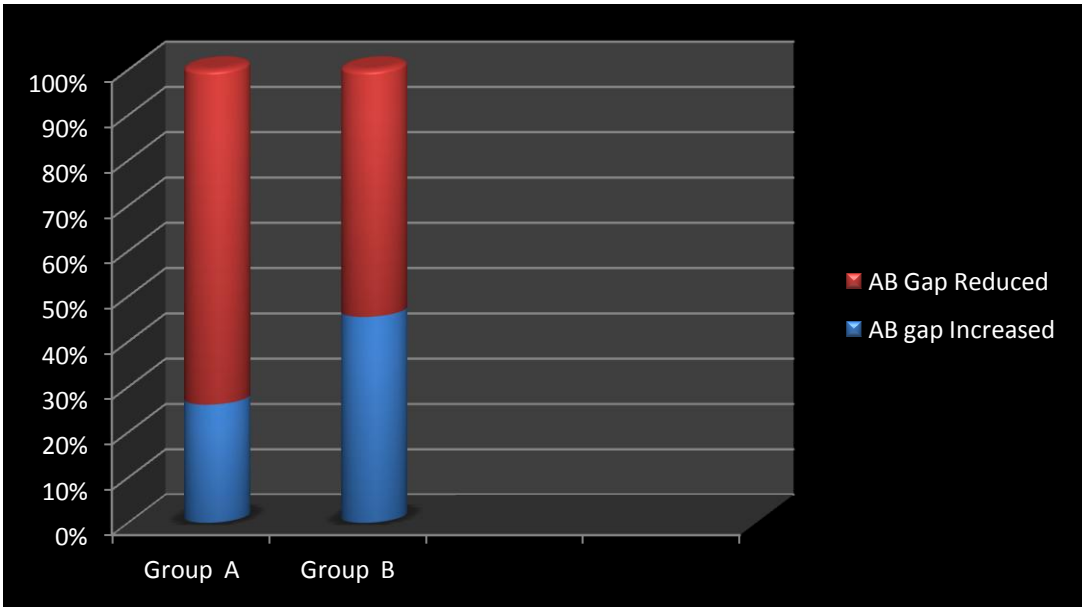
CHI-SQUARE TOTAL = 7.06 ,Degrees of Freedom = (3-1) X (2-1) = 1

P Value < 0.05 -Statistically Significant

Table 15 - Comparison of the AB gap in Pure tone Audiogram between Group A and Group B at 1st month

AB gap in PTA	Group A	Group B	Total
Reduced or remaining static(Hearing Improved)	17(73.9%)	12 (54.54%)	29
Increased(Hearing Worsened)	6 (26.08%)	10 (45.45%)	16
Total	23	22	45

Figure 26 - Chart showing the Comparison of the AB gap in Pure tone Audiogram between Group A and Group B at 1st month

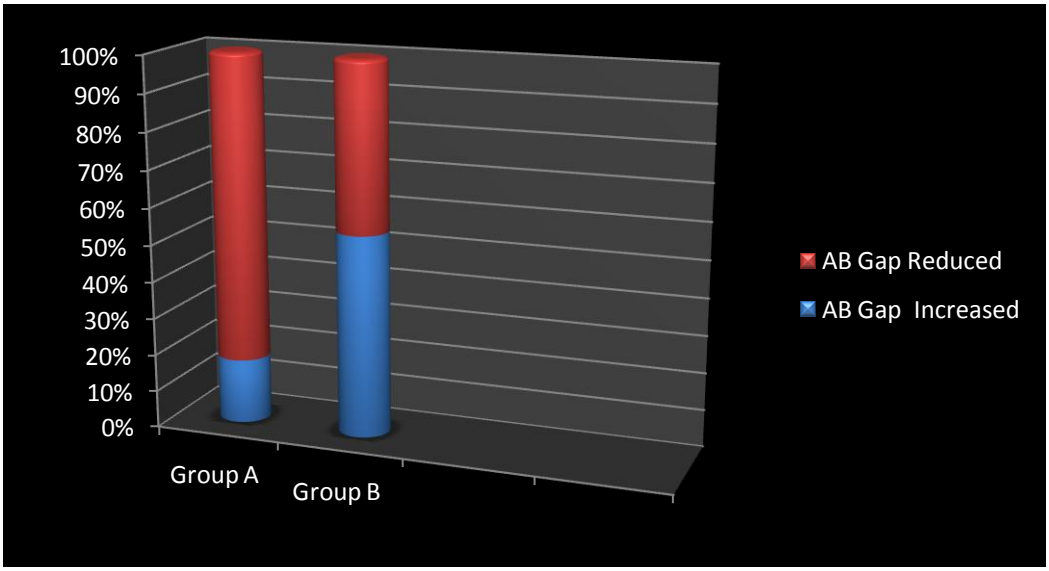


CHI-SQUARE TOTAL = 1.83, Degrees of Freedom = (2-1) X (2-1) = 1P Value < 0.5 -Statistically Not significant.

Table 16 - Comparison of the AB gap in Pure tone Audiogram between Group A and Group B at 3rd month

AB gap in PTA	Group A	Group B	Total
Reduced or remaining static(Hearing Improved)	19(82.6%)	10 (54.54%)	19
Increased(Hearing Worsened)	4 (17.4%)	12 (45.45%)	16
Total	23	22	45

Figure 27 - Chart showing the comparison of the AB gap in Pure tone Audiogram between Group A and Group B at 3rd month



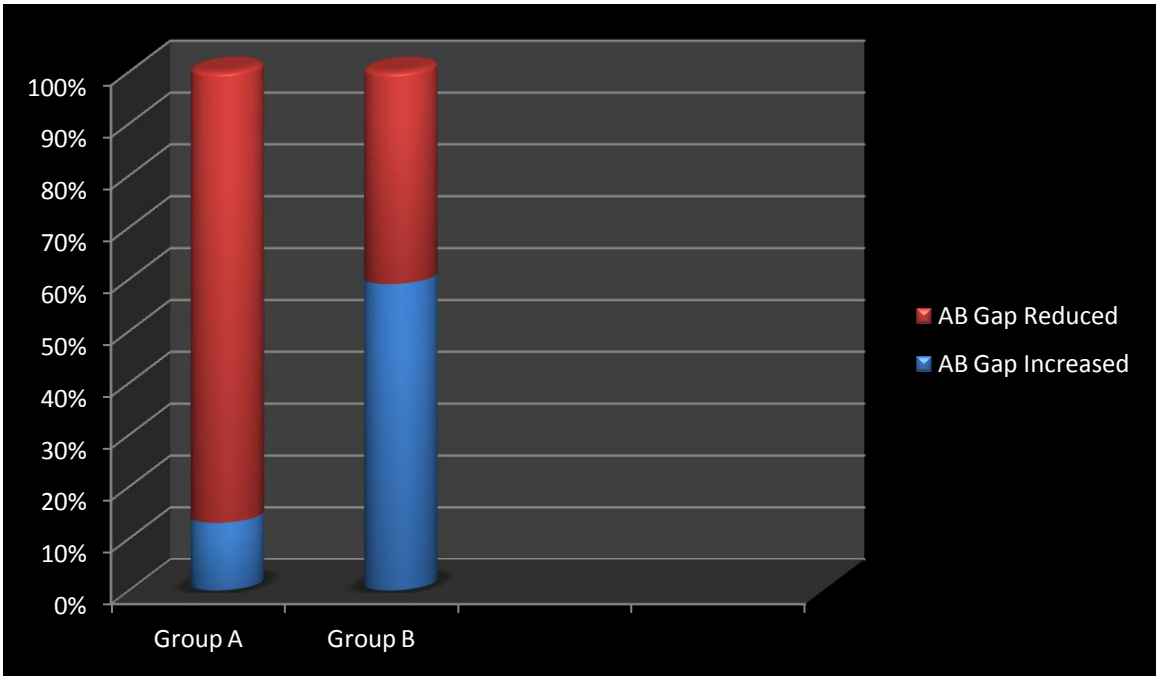
CHI-SQUARE TOTAL = 6.78 , Degrees of Freedom = (2-1) X (2-1) = 1

P Value < 0.01 -Statistically Significant

Table 17 - Comparison of the AB gap in Pure tone Audiogram between Group A and Group B at 6th month

AB gap in PTA	Group A	Group B	Total
Reduced or remaining static(Hearing Improved)	20 (86.9%)	9 (40.9%)	29
Increased(Hearing Worsened)	3 (13.04%)	13 (59.1%)	16
Total	23	22	45

Figure 28 - Chart showing the comparison of the AB gap in Pure tone Audiogram between Group A and Group B at 6th month



CHI-SQUARE TOTAL = 10.41 , Degrees of Freedom = (2-1) X (2-1) = 1

P Value < 0.005 -Statistically Significant

By comparing the results of the two lines of management it is clearly found that statistically significant improvement in results were obtained in group A compared to group B , both with respect to status of retraction and improvement in hearing levels in follow up examinations. From this , it is inferred that myringotomy and grommet insertion has significant advantage over medical measures in managing pars tensa retractions . Even though there was progression of retraction grades, none of the patients in our study group had progression to cholesteatoma indicating that early intervention whether in the form of medical or surgical measures can arrest the progression to cholesteatoma.

DISCUSSION

Retraction pockets of tympanic membrane are frequently encountered in clinical practice and often presents a dilemma in management as most of them will not produce much of symptoms. But its recognized as a definite precursor of cholesteatoma formation. So actively managing retraction pockets at their earliest stage is now the dictum of choice.

Management options for retraction pockets include watchful waiting , medical measures to relieve eustachian tube obstruction , excision of retraction pocket, myringotomy with ventilation tube insertion, Cartilage Tympanoplasty , and Cortical mastoidectomy. [85,86]

The main aim of this study conducted in the Department of ENT , Coimbatore Medical College is to assess the clinical profile of pars tensa retraction pockets , their presenting features, the natural course of the disease , whether early intervention in the form of medical or surgical management can alter their progression towards cholesteatoma and to compare the efficacy of the two lines of management by following up the patients for a span of 6 months.

PATIENT PROFILE

AGE :

In our study it is found that the 36% of patients in Group A and 24% of patients in Group B belonged to the age group 30-39 which was the predominant one. The mean age of Group A was 32.68 years and that of Group B was 30.8 years . Similar age distribution was adapted in the studies conducted by Gupta SC et al (2003),[87] Barbara et al (2008) , Elsheikh et al (2006) , Nankivell PC et al (2010).[88]

GENDER

Almost equal male to female distribution was found in both groups. Most studies did not show much influence of gender on the outcome of disease.

PRESENTING COMPLAINTS

In our study most common presentation was hard of hearing or a blocked sensation of ear in both the groups ie 76% in group A and 72% in group B. This was followed by a ear blockage, dull aching ear pain and tinnitus as the most common symptoms in both the groups. This observations were similar to the studies conducted by Nankivell PC et al (2010)[88] and Mill RP et al (1991)[89].

EXAMINATION FINDINGS

All the patients included in the study had retraction pockets of grades II and III. The percentage of incidence of grade II retraction in group A was 44% and that in group B is 48%. Grade III retraction was found in 56% in group A and 52% in group B. Grade I and IV retractions were not included in the study , as management of grade I retractions is essentially medical and that of . Similar inclusion criteria was used in the study by Walsh RM et al (1995)[89], and van Heerbeek et al (2001)[90] .

PRE OPERATIVE HEARING LEVEL

Mean air-bone gap in Pure tone audiometry was in the range of 31-40 dB (ie. Mild hearing loss) in 48 % of patients in Group A and 52% in group B. 2 patients in group A and 2 in group B had moderate hearing loss in the range of 41-50 dB. These observations in both the groups were comparable with similar study of retraction pockets by Grewal DS et al[92] & Barbara M[93].

IMPEDENCE AUDIOMETRY AT PRESENTATION

In both the groups , the predominant type of curve was Type C (68% in Group A and 64% in Group B). Type C curve indicating the

negative middle ear pressure as the middle ear pathology was predominating , suggesting that chronic eustachian tube dysfunction is the underlying cause for retraction and that middle ear effusion secondary to eustachian tube dysfunction was found in only less than 50% of study population. Wafters GW, Jones JE et al published in clinical otolaryngology about the predictive values of tympanometry in the diagnosis & prognosis of retraction pockets. A type B tympanogram has a high sensitivity (90%) in predicting middle ear effusion and Type C has increased sensitivity of predicting a dry middle ear without effusion.

X RAY MASTOIDS

It is observed that 40% patients in group A and 44% patients in group B have sclerosed mastoids and 40% in Group A and 40% in Group B had diploiec mastoid . This shows a higher incidence of poor cellularity of mastoids in cases with retraction pockets. This finding is in accordance with the studies by Wittmack and Aoki et al (1990). Wittmack (1918) showed by his studies that infantile sterile otitis media occurring in the neonatal period can lead to permanent residual fibrosis and will impair the normal pnuematisation of mastoids and predispose to atelectasis. The studies by Aoki et al also shows that small mastoid volume predisposes to increased negative middle ear pressure and hence to the formation of retraction pockets.

FOLLOW UP EXAMINATION

Both the groups were followed up at regular intervals upto 6 months from the intial presentation. In the group managed by myringotomy and grommet insertion (group A) , 20 patients (86.9%) of patients showed reversal of retraction. Remaining 3(13.04%) patients had persistent or progressing retractions despite active surgical intervention. None of the patients developed complications related to tympanostomy tubes like cholesteatoma , tympanosclerosis, ossicular disruption or granuloma formation. One had grommet extruded prematurely and two had blockage of tympanostomy tubes and had persistent retraction. The follow up audiogram also showed considerable improvement in hearing as compared to preoperative levels as shown by reduction in air-bone gaps in 20 patients (86.9%). This result is comparable to studies conducted by Rath G et al [94] (85 %), Walsh RM et al [95](81%) and Srinivasan et al[96] (74%) where myringotomy and ventilation tube insertion proved an effective and economically advantageous procedure with minimal side effects as compared to other management options like Tympanoplasty and observing conservatively.

In the conservatively managed group reversal of retraction was seen in 14 out of 22 patients (63.6%) and improvement in hearing was observed in 9 patients (40.9%) at the end of 6 months.

Although there was steady improvement in the status of retraction and hearing in these patients with time, the results were not as promising as that of surgically managed group. 8 patients out of 22 had their retraction remaining static or progressing indicating the potential to progress to cholesteatoma. Hence from our study it is clearly seen there was a clinically and statistically significant difference between the groups managed conservatively and surgically by myringotomy and grommet insertion in all the follow up results. Simple excision or myringotomy with ventilation tube insertion should be considered as the first line of management, than more aggressive procedures like reinforcement tympanoplasty using temporalis fascia or cartilage graft, in the management of pars tensa retraction pockets.[97] None of the patients in our study group had progression of retraction to cholesteatoma indicating that early intervention whether in the form of medical or surgical measures can arrest the progression to cholesteatoma.

SUMMARY

In our study the predominant age group was found to be 30- 39 years in both the study groups. There was no significant difference in the incidence among males and females and the gender difference does not seem to significantly affect the study outcome. The predominant symptom with which most patients presented was hard of hearing (76% and 72% in the two groups) followed by ear blockage, otalgia and tinnitus in both the groups. At the intial presentation , the incidence of grade II Pars tensa retraction was 44% in surgically managed groups and 48% in medically managed group and that of grade III retraction was 56% in first group and 52% in second group. Most patients in both the groups mean air - bone gap was 31-40 dB (ie mild conductive hearing loss) at the time of intial presentation. In both the groups the predominant type of Tympanometry curve was C type (68% and 64% respectively) at the time of presentation. The predominant type of mastoid was diploiec and sclerosed (a total of 80% in Group A and 84% in Group B) . During follow up examination for a period of 6 months ,there was definite improvement in the grade of tympanic membrane retractions by reversal of retraction pockets (86.9%) in group managed by grommet insertion with a definite improvement in

hearing levels as suggested by reduction in air – bone gap in pure tone audiograms (87%). In the group of patients treated medically , there was reversal of retraction in 63.9 % of patients with improvement in hearing for 40.9% of patients. The results were analysed and compared using Chi-square testing and found to be statistically significant suggesting that there is a definite advantage of myringotomy and grommet insertion over medical measures in the early management of retraction pockets of tympanic membrane.

CONCLUSION

This study was conducted in the Department of Otorhinolaryngology , Coimbatore Medical College to compare the efficacy of early management of pars tensa retraction pockets by conservative medical methods and by myringotomy and grommet insertion and also to determine whether early intervention can arrest the progression of retraction pockets to cholesteatoma.

The study comprised of 50 patients , 25 of whom were medically managed by medications that improved eustachian tube function and thereby middle ear ventilation and the rest 25 patients were managed by myringotomy and grommet insertion. The patients were followed up regularly for 6 months at first , third and sixth months.

From our study it was inferred that progression of retraction pockets was significantly reduced by early intervention whether it is in the form of medical measures or surgery. By comparing the efficacy of the two lines of management it was found out that surgically managed group showed better outcomes both with respect to the status of retraction as well as degree of hearing improvement. This is in accordance with previous studies in this regard. The incidence of complications following surgery was

not much significant as compared to the favourable outcomes. Early intervention was shown to definitely arrest the progression of retraction pocket to cholesteatoma and thus a ‘safe’ ear to ‘unsafe’ ear.

This prospective study highlights the benefits of early intervention of retraction pockets as compared to ‘watchful waiting’ and the definite advantage of ventilation tube insertion in improving middle ear ventilation and preventing the progression of retraction pocket. A long term follow up is needed to assess the results in a long run , to assess disease relapse and recurrence and the long term sequelae like adhesive otitis media and choleasteatoma.

Thus we conclude that management of pars tensa retractions by myringotomy and grommet insertion is a safe, effective and simple procedure and should be always considered ahead of conservative medical management and extensive tympanoplasty in appropriate cases.

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PROFORMA

NAME :

AGE :

SEX:

OCCUPATION:

ADDRESS:

SOCIOECONOMIC STATUS:

HOSPITAL OP/IP NUMBER:

PRESENTING COMPLAINTS :

1. HARD OF HEARING:
    - ONSET
    - SIDE
    - DURATION
    - PROGRESSIVE OR NOT
    - FLUCTUATING OR NOT
    - HISTORY OF EAR DISCHARGE
    - HISTORY OF OTOTOXIC DRUGS
    - HISTORY OF TRAUMA
    - AUTOPHONY

2. TINNITUS
    - SIDE

- DURATION
- TYPE
- ONSET –SUDDEN / INSIDIOUS
- CHARACTER OF TINNITUS
- AGGRAVATING / RELIEVING FACTORS

3. OTALGIA

- SIDE
- DURATION
- ONSET
- AGGRAVATING / RELIEVING FACTORS

4. ASSOCIATED SYMPTOMS

- EAR DISCHARGE
- VERTIGO
- HEAD ACHE
- NASAL OBSTRUCTION
- POST NASAL DISCHARGE
- RECURRENT ATTACKS OF UPPER RESPIRATORY TRACT INFECTIONS

PAST HISTORY

- ALLERGY

- ASTHMA
- TRAUMA
- OTOTOXIC DRUGS
- PREVIOUS EAR SURGERY
- IRRADIATION
- HYPERTENSION
- DIABETES
- PULMONARY TB

PERSONAL HISTORY

- SMOKING
- ALCOHOLISM
- DIET
- BOWEL AND BLADDER HABITS

FAMILY HISTORY

- HARD OF HEARING
- HISTORY OF CONSANGUINOUS MARRIAGE

SOCIO ECONOMIC HISTORY

GENERAL EXAMINATION

TEMPERATURE

PULSE

BLOOD PRESSURE

PALLOR

ICTERUS

CLUBBING

CYANOSIS

EDEMA

GENERALISED LYMPHADENOPATHY

SYSTEMIC EXAMINATION

- CARDIOVASCULAR SYSTEM
- RESPIRATORY SYSTEM
- CENTRAL NERVOUS SYSTEM
- GASTROINTESTINAL SYSTEM

LOCAL EXAMINATION

EXAMINATION OF EAR : RIGHT

LEFT

PINNA

PRE AURICULAR REGION

POST AURICULAR REGION

EXTERNAL AUDITORY CANAL

MASTOID REGION

TRAGAL SIGN

TYMPANIC MEMBRANE

- PARS TENSA
- PARS FLACCIDA
- HANDLE OF MALLEUS
- COLOUR
- CONE OF LIGHT
- RETRACTED OR NOT
- MOBILITY

TUNING FORK TESTS

- RINNE TEST
- WEBER TEST
- ABSOLUTE BONE CONDUCTION

THREE FINGER TEST

FACIAL NERVE

FISTULA SIGN

VESTIBULAR FUNCTION TESTS

EXAMINATION OF NOSE

- ANTERIOR RHINOSCOPY
- POST NASAL EXAMINATION

EXAMINATION OF THROAT

INVESTIGATIONS

GENERAL INVESTIGATIONS

Complete hemogram

Renal function tests

Urine Routine Examination

Random blood sugar

Chest XRay

ECG

SPECIFIC INVESTIGATIONS

Pure Tone Audiometry

Impedence Audiometry

Video otoscopy

Diagnostic Nasal Endoscopy

X Ray of Paranasal sinuses- Water's view

X Ray Mastoids –Law's view

X Ray of Nasopharynx lateral view for adenoid

CT Scan of paranasal sinuses (in selected cases)

FOLLOW UP EXAMINATION

	1ST MONTH	3RD MONTH	6TH MONTH
VIDEO OTOSCOPY			
PURE TONE AUDIOMETRY			

SL. NO	NAME	IP/OP NO	AGE IN YEARS	SEX	HOH	EAR BLOCK	OTALGIA	TINNITUS	RETRACTION GRADE INITIAL	AB GAP INITIAL	IMPEDENCE INITIAL	TYPE OF MASTOID	RETRACTION GRADE **I**	AB GAP **I**	RETRACTION GRADE **III**	AB GAP **III**	RETRACTION GRADE **VI**	AB GAP **VI**
1	RAJESWARI	50469	21	F	+	-	-	+	II	26.6	C	C	I	23.3	I	20	N	21
2	JAYASUDHA	52156	36	F	-	+	+	-	III	46.6	B	D	IV	48.3	IV	52	1V	54.3
3	AMSAVALLY	14825	38	F	-	-	-	+	II	28.3	C	S	I	30.3	I	26	I	23.3
4	DHANASEKHAR	52576	13	M	+	-	-	-	II	35	C	C	N	30	N	28.3	N	26.3
5	RAMASAMY	72410	53	M	+	+	-	+	III	45	B	D	II	45	I	33	I	28.3
6	PALANIYAMMAL	53006	51	F	+	+	+	-	III	30	C	S	I	23.3	I	20	I	23.3
7	KARTHICK	52562	10	M	+	-	-	+	III	28.3	B	D	II	30.3	I	23	I	23.3
8	SENTHIL	58114	27	M	+	-	-	+	III	30	B	C	III	43	III	45.3	III	35.6
9	MUTHULAXMI	30215	34	F	+	+	-	+	III	33	C	D	II	28.3	II	25.3	II	26.6
10	MAHESWARI	53798	18	F	+	-	+	-	III	28.3	B	S	L	L	L	L	L	L
11	RAFEENA	37155	18	F	+	-	-	-	II	30	C	D	N	28	I	23	I	25
12	MUNEESWARI	42043	26	F	-	+	+	+	III	26	B	D	II	20	II	20	I	18
13	RAHEEMA	65544	33	F	-	+	+	-	II	40	C	S	III	52.3	N	55	III	60

MASTER CHART OF PATIENTS MANAGED WITH GROMMET INSERTION

SL. NO	NAME	IP/OP NO	AGE IN YRS	SEX	HOH	EAR BLOCK	OTALGIA	TINNITUS	RETRACTION GRADE INITIAL	AB GAP INITIAL	IMPEDENCE INITIAL	TYPE OF MASTOID	RETRACTION GRADE **I**	AB GAP **I**	RETRACTION GRADE **III**	AB GAP **III**	RETRACTION GRADE **VI**	AB GAP **VI**
14	KRISHNASAMY	21831	52	M	+	-	-	+	II	30	C	C	I	33	I	28	I	25
15	GEORGE	23047	45	M	+	+	-	+	III	33	B	S	II	28.3	II	30.3	III	33.3
16	SAKTHI	45999	42	F	+	-	-	-	II	40	C	S	II	43	I	38	I	33.3
17	MOHAN	47409	38	M	+	+	-	+	III	30	B	S	II	23	I	23	I	23
18	PANDIYAN	48146	29	M	-	-	-	-	II	35	C	C	N	28	N	25	N	28
19	VELUMANI	21233	35	F	+	-	-	-	III	30.3	C	D	I	20	N	23.3	N	23
20	RAHMATH	50139	35	F	+	+	+	-	II	40	C	D	N	26.6	N	26.6	N	28
21	FIRDOSE	54994	26	F	-	-	+	+	III	40.3	C	S	III	48	III	48.3	III	33.3
22	ARUMUGAM	58250	50	M	+	+	+	+	III	30	C	S	IV	40.3	IV	46.3	IV	48.3
23	MANIKANDAN	59934	35	M	+	-	-	-	II	33	C	D	L	L	L	L	L	L
24	SUBAIR	60756	22	M	+	-	-	+	III	40	C	D	III	40	III	38.3	II	33.3
25	ABDUL BASITH	60360	30	M	+	+	-	+	II	38.3	C	S	N	33	N	33.3	N	28.3

MASTER CHART OF PATIENTS MANAGED WITH GROMMET INSERTION

MASTER CHART OF PATIENTS MANAGED MEDICALLY

SL. NO	NAME	IP/OP NO	AGE IN YRS	SEX	HOH	EAR BLOCK	OTALGIA	TINNITUS	RETRACTION GRADE INITIAL	AB GAP INITIAL	IMPEDENCE INITIAL	TYPE OF MASTOID	RETRACTION GRADE **I**	AB GAP **I**	RETRACTION GRADE **III**	AB GAP **III**	RETRACTION GRADE **VI**	AB GAP **VI**
1	AJAY	88671	18	M	-	+	-	-	II	25	C	C	I	26.3	I	21.3	I	20.3
2	MARUTHAYAMMAL	14122	48	F	+	-	-	+	III	35	B	D	III	36.6	III	40	III	43.3
3	RAMJITHAM	37155	52	F	+	+	-	-	II	35	C	S	II	38.3	III	43.3	IV	45
4	SHANKAR	22859	21	F	+	-	-	-	III	33.3	C	S	II	30	II	28.3	II	23.3
5	ARUKUTTY	58115	36	F	+	-	+	+	III	38	B	D	III	43.3	III	45	IV	50
6	THOUFIQ	58055	18	M	+	+	-	-	III	33.3	C	S	L	L	L	L	L	L
7	SRIRAM	40336	14	M	-	+	+	+	II	43	C	C	II	38.3	II	33.3	I	28.3
8	GURUNATHAN	52562	54	F	+	-	-	+	III	30	B	D	III	33.3	III	38	III	43.3
9	DHANDAPANI	47409	48	M	+	+	-	+	II	28	C	S	II	23.3	I	23.3	I	25
10	ARIVALAGI	13482	40	M	+	-	+	-	III	35	C	S	L	L	L	L	L	L
11	ALAGIRISAMY	48362	41	M	+	-	-	+	III	30.3	B	D	III	38.3	IV	43	IV	45
12	RAJAMMAL	31233	52	M	-	+	+	+	II	33	C	D	I	30	I	28.3	I	26.6
13	PRABHU	54994	38	M	+	-	+	-	II	35	C	C	III	38.3	III	43.3	III	48.3
14	RAJESWARY	50139	21	F	-	+	-	+	II	26	C	S	I	28.3	I	23.3	I	23
15	SUNDARAM	63956	53	M	+	-	-	+	III	43	B	S	III	48.3	III	52	IV	55
16	KRISHNAVENI	66573	26	F	-	-	+	+	II	30	C	D	I	28.3	I	26.6	I	25
17	VEERAMMAL	65126	38	F	+	+	-	+	III	36.3	B	S	L	L	L	L	L	L
18	KANNAGI	62245	36	F	+	+	+	-	III	30	C	S	III	38.3	III	43.3	IV	45

SL. NO	NAME	IP/OP NO	AGE IN YRS	SEX	HOH	EAR BLOCK	OTALGIA	TINNITUS	RETRACTION GRADE INITIAL	AB GAP INITIAL	IMPEDENCE INITIAL	TYPE OF MASTOID	RETRACTION GRADE **I**	AB GAP **I**	RETRACTION GRADE **III**	AB GAP **III**	RETRACTION GRADE **VI**	AB GAP **VI**
19	SARAVANAN	67048	18	M	+	-	-	+	II	38	C	C	II	40	II	43	II	43.3
20	MOHANRAJ	70780	37	M	+	+	-	+	II	26.6	C	D	II	26.3	II	23.3	II	25
21	SARASWATHY	69722	52	F	-	+	-	-	III	33.3	B	D	III	45.3	III	45	IV	48.3
22	MURUGASAMY	25305	42	M	+	-	+	+	III	36	B	S	II	36.3	II	36	II	40.3
23	HARIHARAN	73463	24	M	-	+	-	+	II	28	C	D	III	30.3	III	33.3	III	38.3
24	KALA	64745	49	F	+	-	-	-	III	38	B	S	II	36.6	II	38	II	28.3
25	RAJENDRAN	60360	32	M	+	+	+	-	II	33	C	D	III	33.3	IV	38.3	IV	40

KEY TO MASTER CHART

SL.NO	Serial Number
M	Male
F	Female
HOH	Hard Of Hearing
AB GAP	Air- Bone Gap
Type of Mastoid C S D	 Cellular Sclerosed Diploiec
Retraction Grade I	Retraction Grade At First month Follow Up
Retraction Grade III	Retraction Grade At Third month Follow Up
Retraction Grade VI	Retraction Grade At Sixth month Follow Up
AB Gap I	Air-Bone Gap in Pure Tone Audiometry at First Month Follow up
AB Gap III	Air-Bone Gap in Pure Tone Audiometry at Third Month Follow up
AB Gap VI	Air-Bone Gap in Pure Tone Audiometry at Sixth Month Follow up
L	Lost to follow up

CONSENT FORM

Yourself Mr./Mrs./Ms…….. is being asked to be a participant in the research study titled "An interventional study of Pars tensa retraction pockets - A comparison between grommet insertion and medical management" in Coimbatore Medical College Hospital, Coimbatore, conducted by Dr.Chithra Revi, Post Graduate Student, Department of ENT, Coimbatore Medical College. You are eligible after looking into the inclusion criteria. You can ask any question you may have , before agreeing to participate.

Research Being Done

An interventional study of Pars tensa retraction pockets - A comparison between grommet insertion and medical management

Purpose of Research

1. To find out whether early intervention of retraction pockets can prevent progression to cholesteatoma

2. To compare the efficacy of myringotomy and grommet insertion and medical measures in the management of retraction pockets

Procedures involved

50 patients attending the ENT OP department of Coimbatore Medical college Hospital , who are having tympanic membrane pars tensa retraction are selected & evaluated with Videootoscopy , Pure tone audiogram , Impedence audiometry , Diagnostic Nasal Endoscopy & in selected patients using X Rays . Patients with retraction pockets & having no other predisposing causes , will be divided into 2 groups. Grommet insertion will be done in one group with grade II & III retraction & other group will be observed for progression of retraction. Postoperative monthly follow up will be done for 6 months using videootoscopy & impedence audiometry. & outcome is observed.

Decline from Participation

You have the option to decline from participation in the study existing protocol for your condition.

Privacy and Confidentiality

Privacy of individuals will be respected and any information about you or provided by you during the study will be kept strictly confidential.

Authorization to publish Results

Results of the study may be published for scientific purposes and/or presented to scientific groups, however you will not be identified.

Statement of Consent

I volunteer and consent to participate in this study. I have read the consent or it has been read to me. The study has been fully explained to me, and I may ask questions at any time.

---------- ----------

Signature /Left thumb impression Date

(volunteer)

---------- ----------

Signature of witness Date

FIG 29.NORMAL TYMPANIC MEMBRANE RIGHT SIDE

FIG 30.NORMAL TYMPANIC MEMBRANE LEFT SIDE

FIG 31 . HISTOLOGY OF NORMAL TYMPANIC MEMBRANE

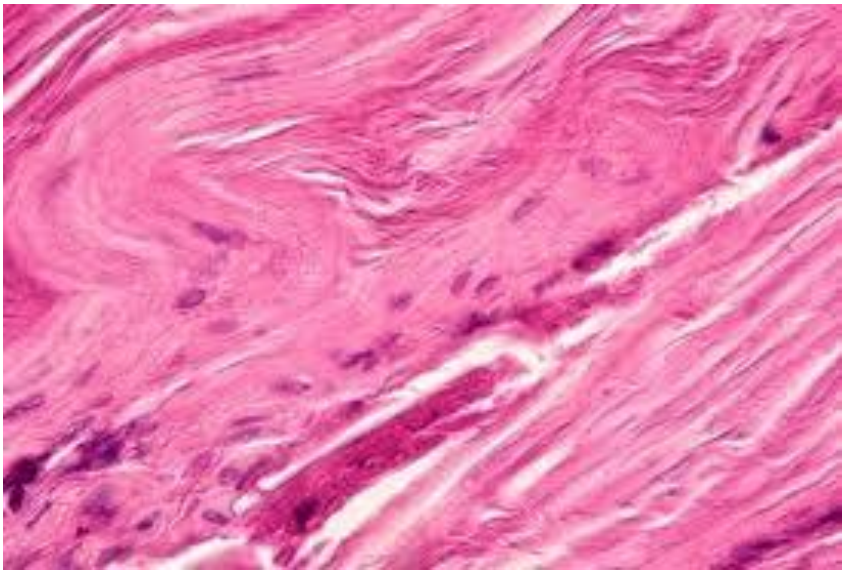


FIG 32 . HISTOLOGY OF RETRACTION POCKET

FIG 33 . SADE'S GRADE I RETRACTION

FIG NO 34. SADE'S GRADE II RETRACTION

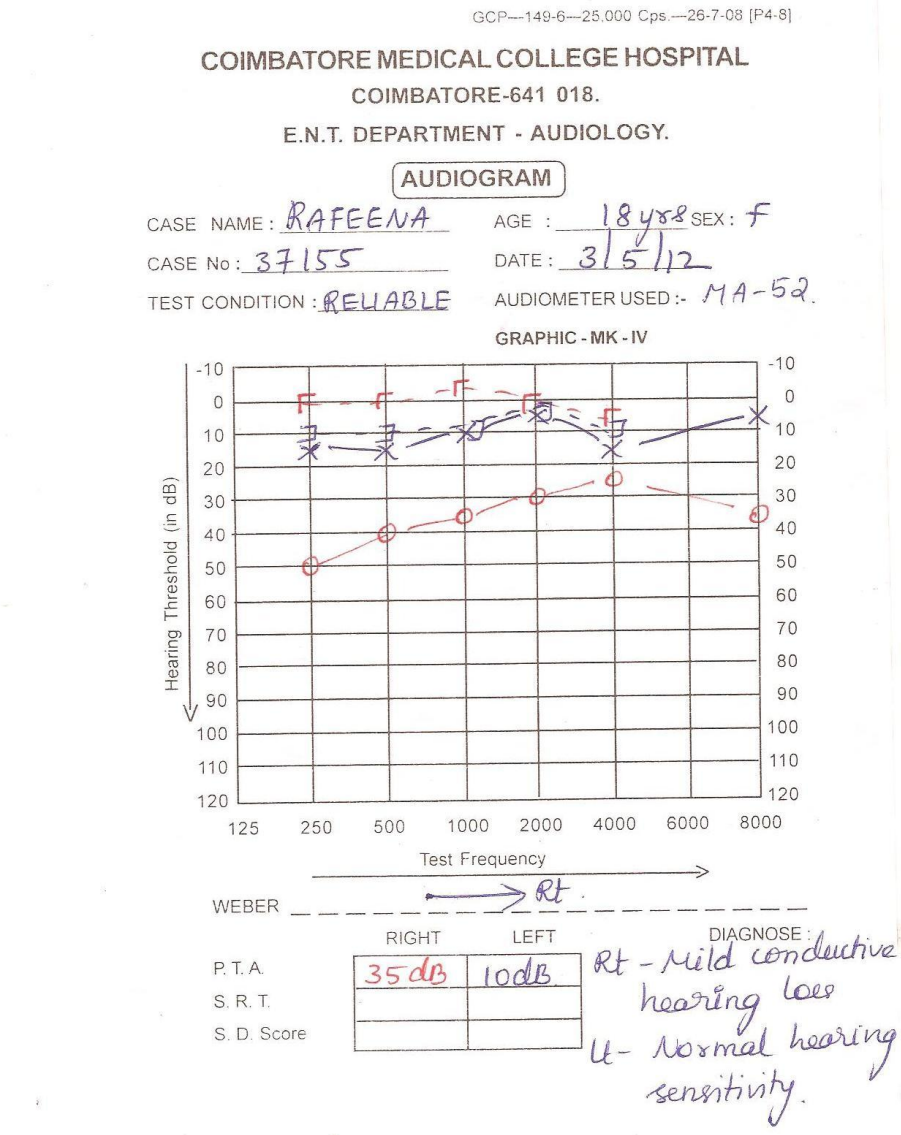
FIG. NO. 35 SADE'S GRADE III RETRACTION

FIG. NO. 36. SADE'S GRADE IV RETRACTION (ADHESIVE OTITISMEDIA)

FIG. NO.37. RETRACTION POCKET WITH CHOLESTEATOMA

FIG . NO. 38. ENDOSCOPIC VIEW OF EUSTACHIAN TUBE ORIFICE

FIG. NO.39. PURE TONE AUDIOGRAM - CONDUCTIVE HEARING LOSS



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COIMBATORE MEDICAL COLLEGE HOSPITAL

COIMBATORE-641 018.

E.N.T. DEPARTMENT - AUDIOLOGY.

AUDIOGRAM

CASE NAME : RAFEENA AGE : 18 yrs SEX : F

CASE No : 37155 DATE : 3/5/12

TEST CONDITION : RELIABLE AUDIOMETER USED :- MA-52.

GRAPHIC - MK - IV

Hearing Threshold (in dB)

-10 0 10 20 30 40 50 60 70 80 90 100 110 120

125 250 500 1000 2000 4000 6000 8000

Test Frequency

WEBER Rt.

	RIGHT	LEFT
P. T. A.	35 dB	10 dB
S. R. T.		
S. D. Score		

DIAGNOSE :

Rt - Mild conductive hearing loss

Lt - Normal hearing sensitivity.

FIG. NO. 40. IMPEDANCE AUDIOMETRY – TYPES OF CURVES

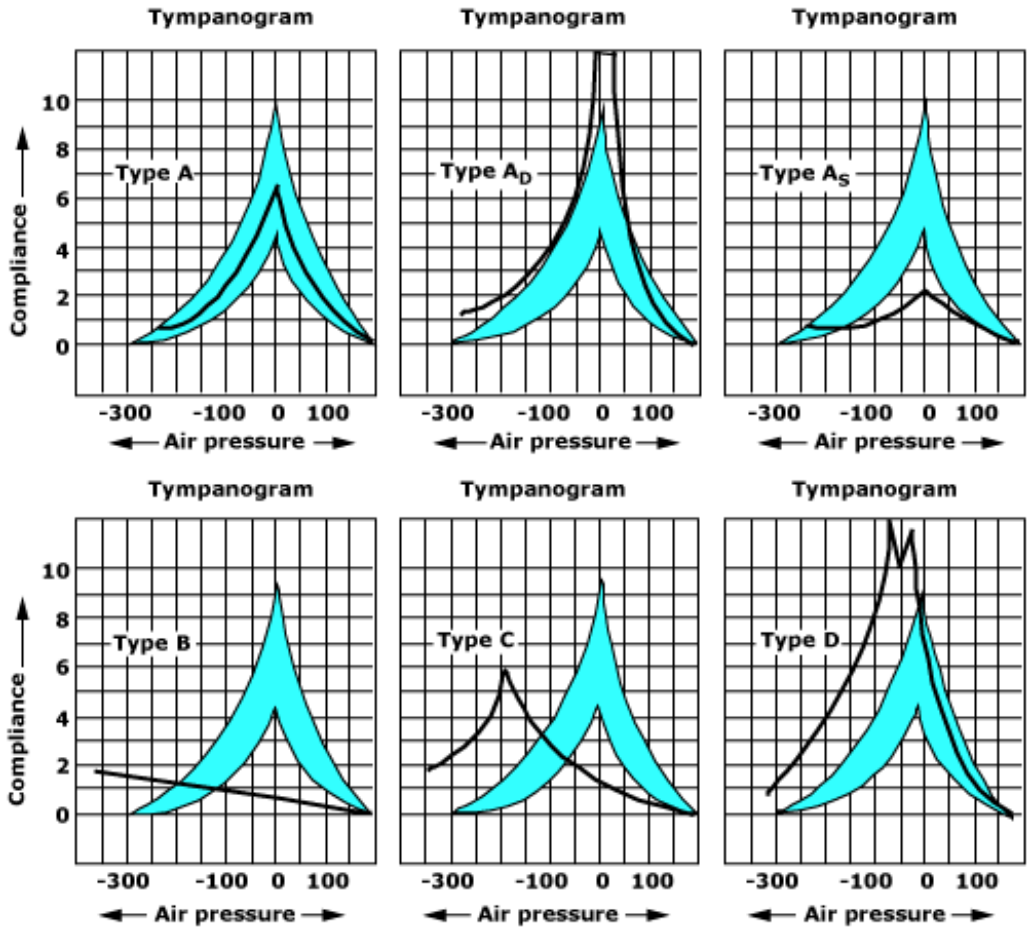
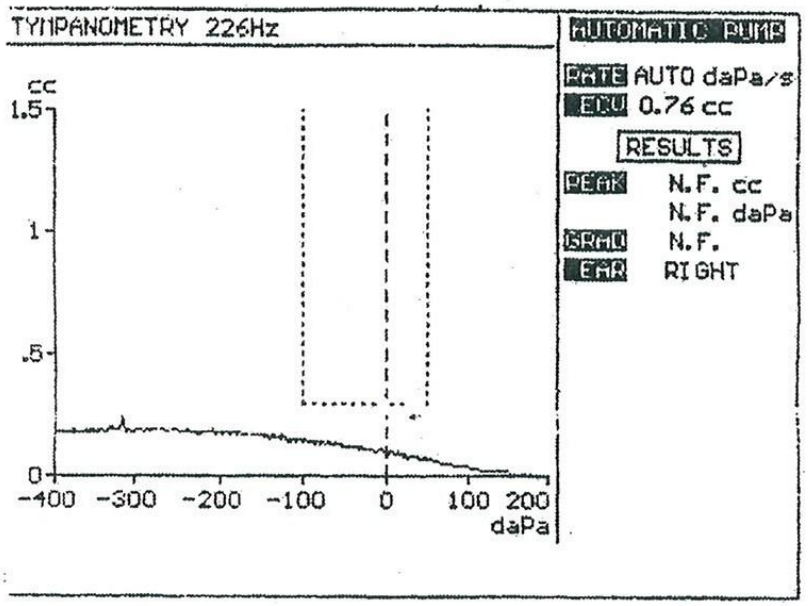


FIG. NO .41. IMPEDANCE AUDIOMETRY TYPE B CURVE


TYMPANOMETRY 226Hz
cc
1.5
1
.5
0
-400 -300 -200 -100 0 100 200
daPa
AUTOMATIC PUMP
RATE AUTO daPa/s
ECV 0.76 cc
RESULTS
PEAK N.F. cc
N.F. daPa
GRAD N.F.
EAR RIGHT

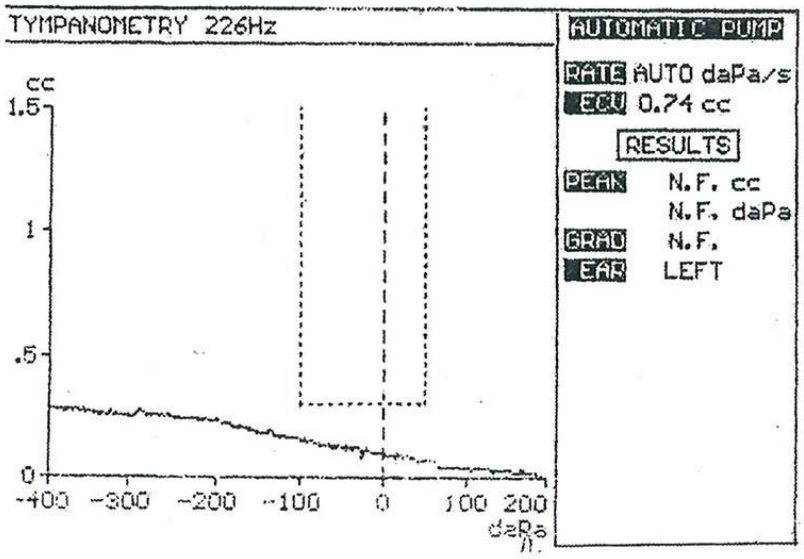

TYMPANOMETRY 226Hz
cc
1.5
1
.5
0
-400 -300 -200 -100 0 100 200
daPa
AUTOMATIC PUMP
RATE AUTO daPa/s
ECV 0.74 cc
RESULTS
PEAK N.F. cc
N.F. daPa
GRAD N.F.
EAR LEFT

FIG. NO.42. IMPEDANCE AUDIOMETRY TYPE C CURVE

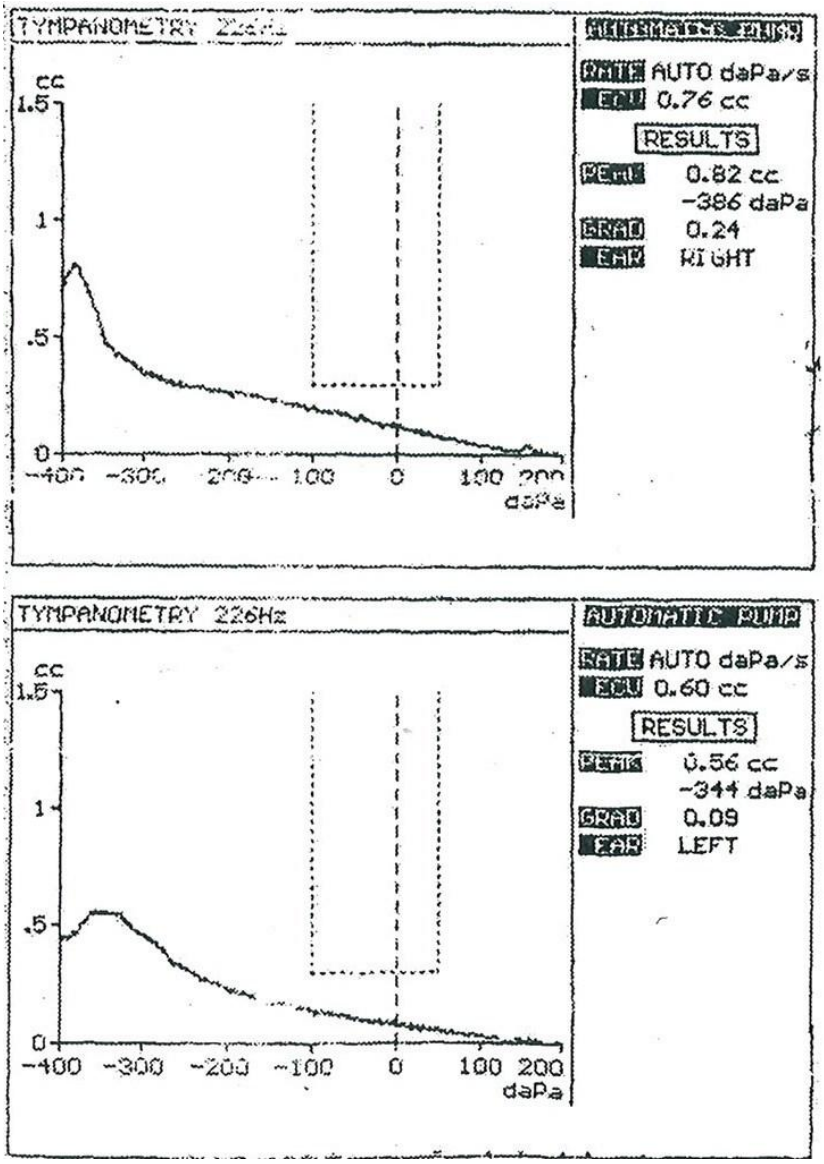


FIG.NO. 43. X RAY MASTOIDS LAW'S VIEW - RIGHT SIDE

FIG. NO.44. X RAY MASTOIDS LAW'S VIEW - LEFT SIDE

FIG NO. 45. MYRINGOTOMY

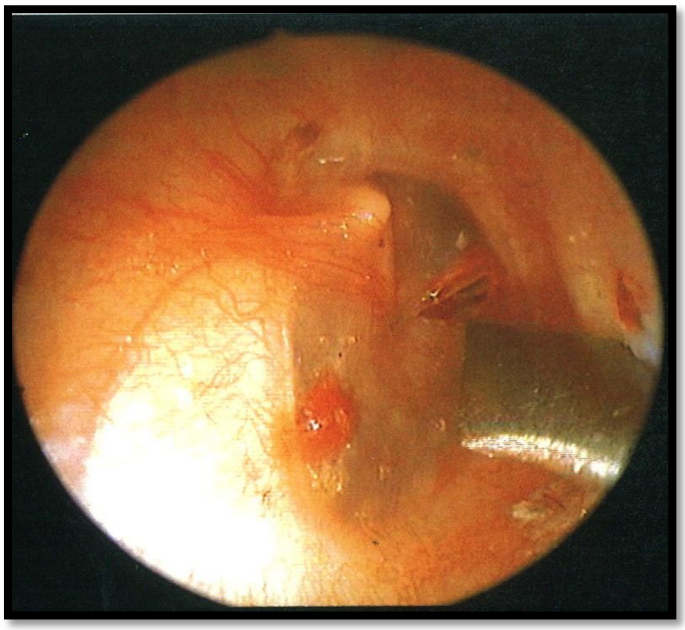


FIG. NO.46. SHEPARD'S GROMMET INSITU

FIG. NO.47. POSTOPERATIVE PICTURE AT 6 MONTHS

FIG . NO. 48.TYPES OF TYMPANOSTOMY TUBES

Armstrong Grommet Ear Tubes

Armstrong Beveled Ear Tubes

Donaldson Ear Tube

T-Tube Ear Tube

Paparella II Ear Tube

Paparella Ear Tubes

Angled Tab Bobbin Ear Tube

Collar Button Ear Tubes

Shepard Design Ear Tube with Tail